

CLACKAMAS/HOOD RIVER HABITAT ENHANCEMENT PROJECT  
1988-1992 IMPLEMENTATION PLAN AND STATEMENT OF WORK

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CLACKAMAS/HOOD RIVER HABITAT ENHANCEMENT PROJECT  
1988-1992 Implementation Plan and Statement of Work

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**Clackamas/Hood River Habitat Enhancement Project**  
**1988-1992 Implementation Plan and Statement of Work**

**ABSTRACT**

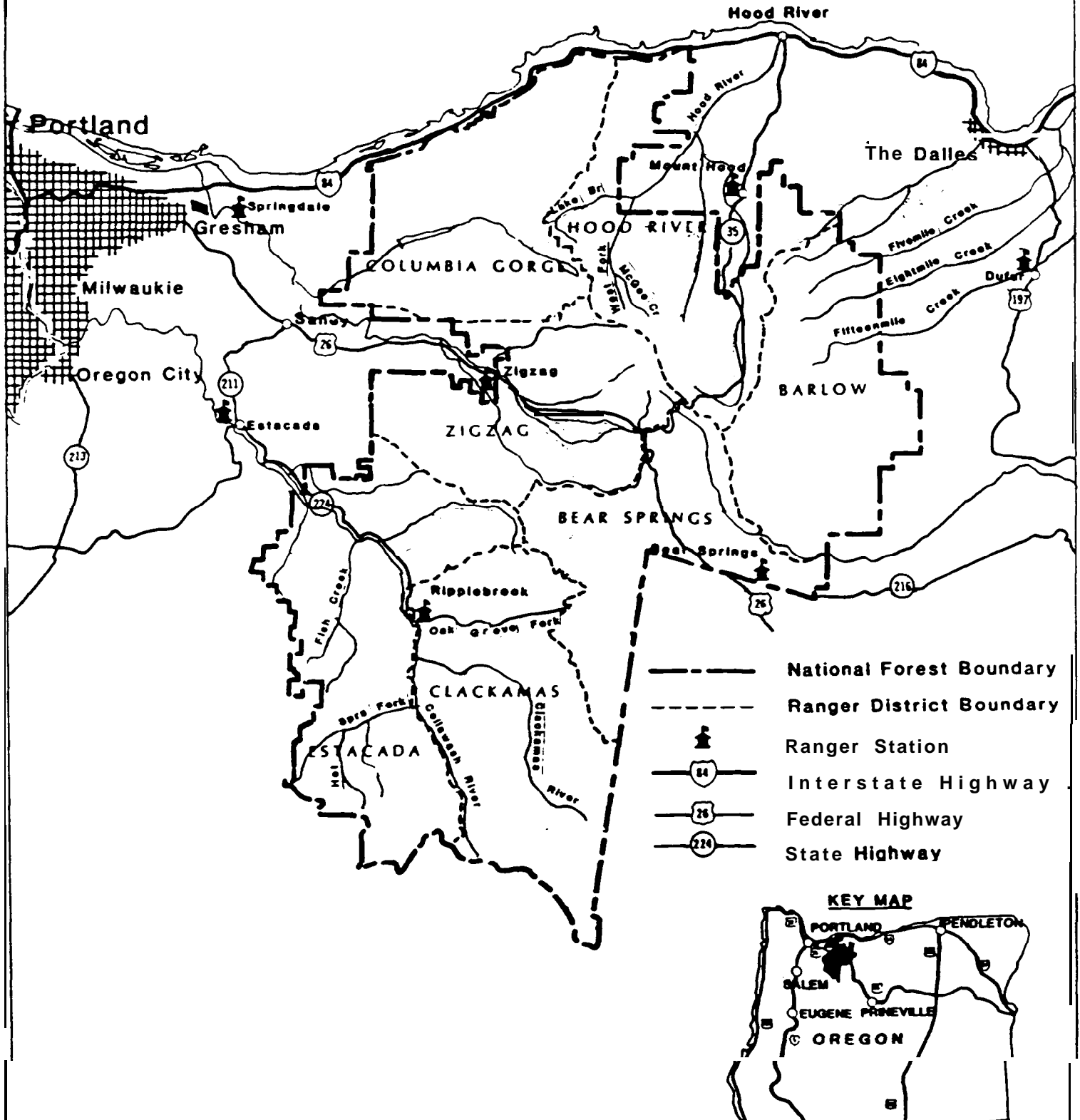
An Implementation Plan and Statement of Work is provided for high priority work in the Clackamas, Hood River and Fifteenmile sub-basins. These documents describe fish habitat improvement opportunities that can be implemented by the 1991 deadline established by the Northwest Power Planning Council. The Clackamas/Hood River Enhancement Program is an on-going project initiated in 1984. It is being cooperatively funded by the Bonneville Power Administration and the Wt. Hood National Forest. Species for management emphasis include spring chinook and coho salmon, and summer and winter steelhead trout. Improvement activities are designed to improve access at passage barriers and increase the quality and quantity of available rearing habitat. Project work will result in improved access to about 12.5 miles of high quality habitat, creation of nearly 70,000 square feet of off-channel habitat, and the addition of structure to approximately 32 miles of stream. At completion of the project, annual production capability from these two sub-basins will be increased by 85-100,000 smolts. Details of a monitoring and evaluation effort consistent with measure 200(d)(1) of the Council's Fish and Wildlife Program are also provided.

**INTRODUCTION**

Fisheries habitat improvement work is being implemented in the Clackamas, Hood River, and Fifteenmile Creek sub-basins under Program Measure 703(c), Action Item 4.2 of the Northwest Power Planning Council's Fish and Wildlife Program (NWPPC 1987). The Bonneville Power Administration (BPA) initiated funding of the Clackamas/Hood River Habitat Improvement Project in 1984. Subprojects are being implemented on the West Fork Hood River, Fish Creek, Collawash River, the Hot Springs Fork Collawash River, the Oak Grove Fork Clackamas River, and in the Fifteenmile Creek drainage (FIGURE 1). This implementation plan and statement of work describes the highest priority remaining improvement opportunities that can be completed in these drainages by the 1991 deadline established by the Council (Action Item 4.2). Sub-basin plans are currently being developed which will set priorities for additional improvement work in the Clackamas, Hood River, and Fifteenmile Creek sub-basins.

Fisheries habitat in large portions of the Clackamas, Hood River, and Fifteenmile Creek sub-basins has been impacted by land management activities, such as timber harvest, livestock grazing, road development, channelization, and debris removal. These activities, in combination with catastrophic floods in 1964 and 1974, have resulted in stream channel changes including: increases in width/depth ratio, stored sediment volume, and bank instability, and decreases in stream shading, in-stream cover, low flow stream area and pool volume, flood plain storage capacity and stability, and sinuosity. These channel changes have reduced anadromous fish production capability in the sub-basins.

FIGURE 1. Area map for clackamas/Hood River Habitat Enhancement Project  
Subproject streams are identified.



Species for management emphasis in Clackamas River tributaries include winter steelhead trout (Salmo gairdneri) and coho (Oncorhynchus kisutch) and spring chinook salmon (O. tshawytscha). The primary management emphasis species in the Hood River sub-basin are summer and winter steelhead and spring chinook salmon. Winter steelhead is the management emphasis species in the Fifteenmile Creek sub-basin. Proposed project work is primarily focused on increasing the quantity and quality of available rearing habitat, and improving access at passage barriers. Improved quality, quantity and distribution of spawning gravel is a secondary benefit of many of the projects. The underlying theme of the improvement work is to increase habitat diversity through the introduction of "structure". Structure, provided by logs, root wads, and boulders serves to deflect, pond or otherwise disrupt flow patterns within a stream channel. This alteration of flow patterns results in formation of habitat niches (e.g. pools, glides, alcoves, depositional areas which collect and retain spawning gravel, etc.) necessary to meet the life history requirements of a variety of species and age groups of salmon and trout. Structure is being introduced in a way that mimics observed natural patterns, quantities and distribution. Habitat improvement efforts funded by BPA in these two sub-basins will be complemented by a variety of fish habitat and watershed restoration projects funded by the Forest Service. To date, the financial commitment of the Forest has roughly matched that of BPA.

In addition to these direct habitat improvement efforts, BPA and the Forest Service are cooperatively financing a number of project and program monitoring activities consistent with measure 200(d)(1) of the Council's Fish and Wildlife Program (NWPPC 1987). The limited monitoring and evaluation effort being funded in the Clackamas and Hood River sub-basins has yielded the benefits anticipated by the Council. Those are, 11.. ensuring that ratepayers' expenditures for fish and wildlife measures are well spent": to "...further the Council's policy of adaptive management. To minimize the risks of management and enhancement decisions..."; and to "...provide feedback to the Council, so that ineffective actions can be identified and management strategies modified accordingly." Studies at Fish Creek. and elsewhere in these two sub-basins have yielded significant findings relating to the durability of habitat improvement structures, the associated changes in physical habitat, and biological response to the improvement activities. Pending development and adoption of a monitoring and evaluation plan by the Council, the Forest Service and BPA plan in this Statement of Work to continue to cooperatively fund limited monitoring and evaluation activities in the Clackamas and Hood River sub-basins.

This Implementation Plan and Statement of Work have been developed in cooperation with biologists from the Oregon Department of Fish and Wildlife (ODFW), the Confederated Tribes of the Warm Springs, the Bonneville Power Administration, and Portland General Electric. Implementation of the plan relies on continued commitment to the effective, cooperative working relationship that has characterized project implementation since 1984.

# 1988/1992 IMPLEMENTATION PLAN & WORK STATEMENT

## WEST FORK HOOD RIVER DRAINAGE

### ADMINISTRATIVE SUMMARY:

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Project Number: 84:11. Subproject I

Project Period: April 1, 1988 - March 31, 1992

Project Headquarters: USDA Forest Service  
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### I. INTRODUCTION

Background. The West Fork Hood River is a fifth order tributary to the Hood River, entering the mainstem at approximately river mile (RM) 12 (FIGURE 2). Draining the northwest side of Mt. Hood and the east side of the Pacific Crest, the West Fork system contains approximately 33 miles of anadromous fish habitat accessible to winter and summer steelhead trout and spring chinook salmon. Resident trout species include rainbow trout (Salmo gairdneri), cutthroat trout s. clarki, brook trout (Salvelinus fontinalis), and an occasional brown trout (S. trutta). Non-game species are mainly composed of various species of sculpin (Cottus sp.). Flow regimes of West Fork basin streams are similar to west-side Cascade streams. Peak flows, which are sometimes quite severe, occur in the winter and are usually associated with warm rain-on-snow events. Summer flows are typically very low.

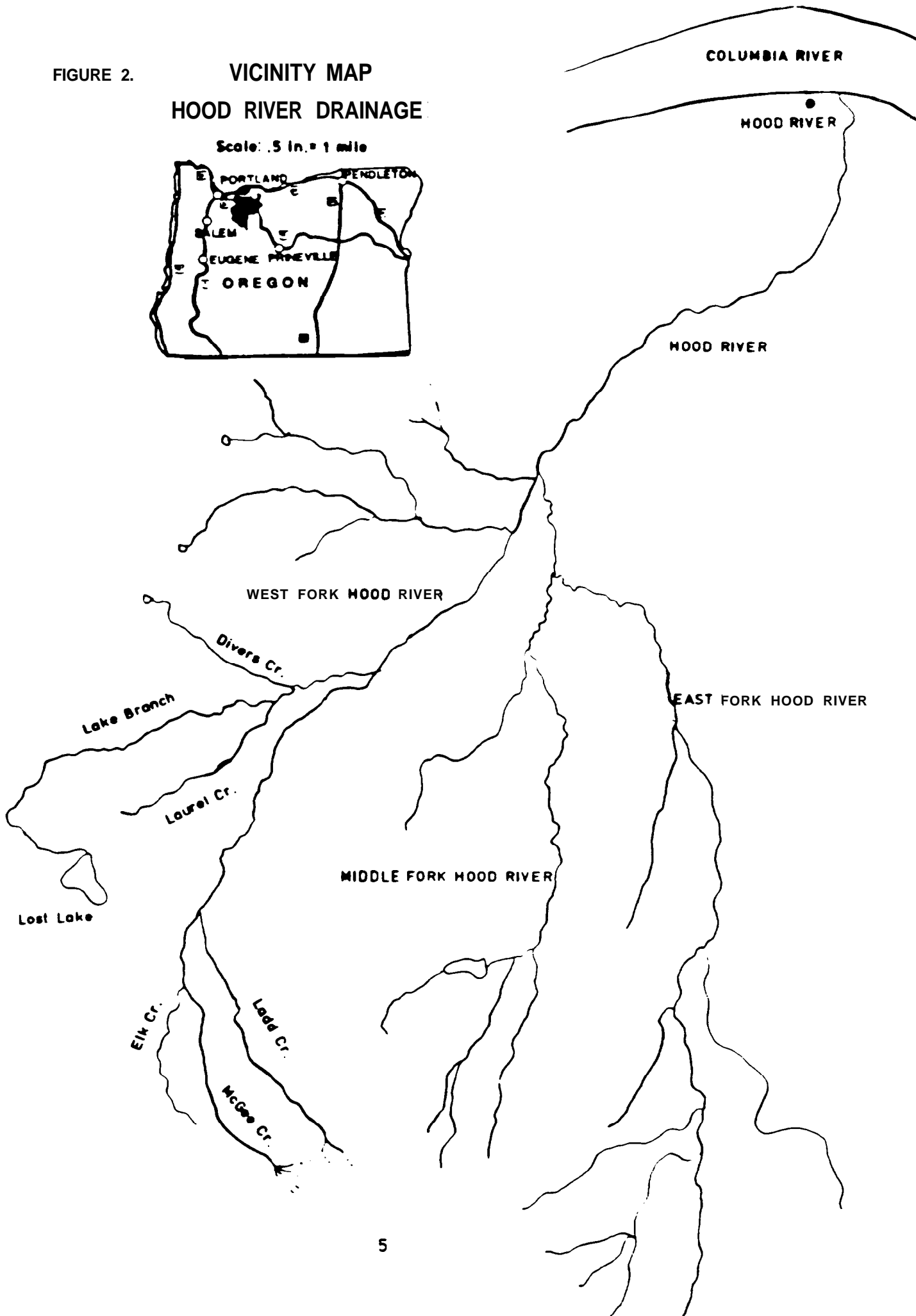
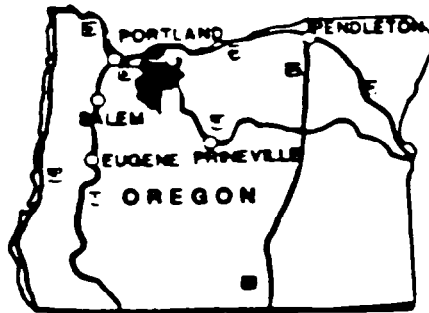
Land ownership in the West Fork Basin is private timberlands intermingled with National Forest System lands. Timber management is the dominant land use within the basin.

The West Fork Hood River Project represents a multi-year, joint effort between the Mt. Hood National Forest (Forest Service) and the Oregon Department of Fish and Wildlife in coordination with the Confederated Tribes of Warm Springs, to improve anadromous fish production in the West Fork Hood River drainage. The project is being implemented with Bonneville Power Administration funding as part of program measure 703(C). Action Item 4.2 of the Northwest Power Planning Council's Fish and Wildlife Program (NWPPC 1987). Habitat improvement activities were initiated in the basin in 1983. Since then, the Forest Service has installed approximately 130 in-stream structures. ODFW has completed complimentary fish passage projects at RM 5.5 of the West Fork and RM 2.8 of the Lake Branch, a major tributary to the West Fork. The mainstem West Fork

FIGURE 2.

# VICINITY MAP HOOD RIVER DRAINAGE

Scale: .5 in. = 1 mile





Hood River project was completed with BPA funding while the Lake Branch project was completed by the Salmon Trout Enhancement Program (STEP). STEP is an ODFW program in which the state provides technical assistance and sometimes partial funding, but the projects are primarily volunteer efforts to accomplish local fishery objectives. In addition to the BPA funded work, the Forest Service has completed in-stream habitat improvement and watershed improvement projects with Forest Service funding. Completed projects have included repairing road drainage systems and closing roads to reduce sediment delivery to stream courses, and placing in-stream structures to improve spawning and rearing habitat quantity and quality. Additional Forest Service funded project work is planned as monies become available from timber sales in the basin. The Knudsen-Vandenberg (KV) Act allows the Forest Service to use revenues generated by timber sales to improve resources, including fish habitat, within the timber sale area.

Fisheries Resource. Management emphasis for the West Fork Hood River drainage is natural production of summer steelhead trout and spring chinook salmon. Summer steelhead are the most abundant anadromous species in the system. ODFW has annually supplemented natural production by releasing about 80,000 summer steelhead smolts.

The winter steelhead population in the West Fork is naturally reproducing. There has been no winter steelhead smolt outplanting. Winter steelhead populations are depressed in the Hood River Basin and there appears to be a downward trend in the population. The downward trend is due to poor habitat conditions throughout the basin, especially in the East Fork drainage and mainstem Hood River tributaries.

Spring chinook salmon are very depressed in the Hood River Basin and probably only a remnant population remains. The extent of spring chinook use in the West Fork is not known. The Oregon Department of Fish and Wildlife has been attempting to supplement spring chinook production in the West Fork basin by outplanting hatchbox fry raised by STEP volunteers.

Limiting Factors. Limiting factors have been identified for three major production areas in the West Fork drainage. This information is based on Forest Service stream survey data, discussions with ODFW biologists, and ratings assigned by the Technical Advisory Committee for the Hood River sub-basin planning process.

Lake Branch. Current habitat quality in Lake Branch is rated as fair for steelhead production. Factors limiting steelhead production include a lack of pool, glide and deep riffle habitat preferred for rearing by 1+ and older juvenile steelhead, and a lack of cover for the existing suitable rearing habitat. Current spring chinook salmon production capability is rated as poor. Chinook production is limited by the quantity and quality of preferred water rearing habitats, inadequate and poorly distributed adult holding habitat, and a lack of spawning habitat. Most of the suitable gravel in Lake Branch is deposited on the stream margins where it is available for use by spring spawning steelhead. but due to low flows is unavailable for late summer/fall spawning salmon.

West Fork/McGee Creek. Stream channels in the West Fork and McGee Creek are riffle dominated (i.e. approximately 75% riffle), with little low flow

pool, glide or deep riffle habitat preferred for rearing by 1+ and older steelhead trout. The available pools are generally shallow, less than one foot deep, with poor to fair cover. The lack of quiet water habitat is also believed to limit spring chinook summer and over-winter rearing success. Suitable spawning gravel, as in Lake Branch, tends to be located along the channel margins and may limit use by fall spawning chinook.

Laurel Creek. Anadromous fish access to Laurel Creek is currently blocked by a series of small falls and chutes near the mouth. There are approximately 2.5 miles of potential steelhead habitat above the barriers, although production potential is rated as poor due to low flows, a dominance of riffle habitats, and poor cover.

Adverse impacts to anadromous fish habitat in the West Fork Hood River basin have mainly resulted from past timber management activities. Logging in riparian areas and stream cleanout practices have removed large in-stream woody debris and reduced the potential for future large wood input. Large woody debris is a critical structural component necessary for pool development, cover, collecting spawning gravel and generally providing a diverse aquatic habitat. Removal of the wood has resulted in the riffle dominated channels with locally limited spawning gravel and poor quality rearing habitat that limit salmon and steelhead production in the West Fork drainage.

Project Description. For the purposes of this Implementation Plan the West Fork Habitat Improvement Project is divided into three components. They are described below. TABLE 1 presents a summary of low flow habitat area for each treatment reach in the West Fork drainage. FIGURE 3 maps the habitat improvement reaches referenced in the Implementation Plan.

Lake Branch Habitat Improvement. Lake Branch is a major anadromous fish tributary to the West Fork Hood River, entering the mainstream at approximately RM 5.5. The lower 3.4 miles of Lake Branch flow through private timber land while the remainder of the stream flows through the Mt. Hood National Forest. Lake Branch is 11 miles long with approximately 9.5 miles available for anadromous fish production. Summer steelhead and probably winter steelhead inhabit Lake Branch. Habitat exists for spring chinook salmon, but the extent of chinook use is not known.

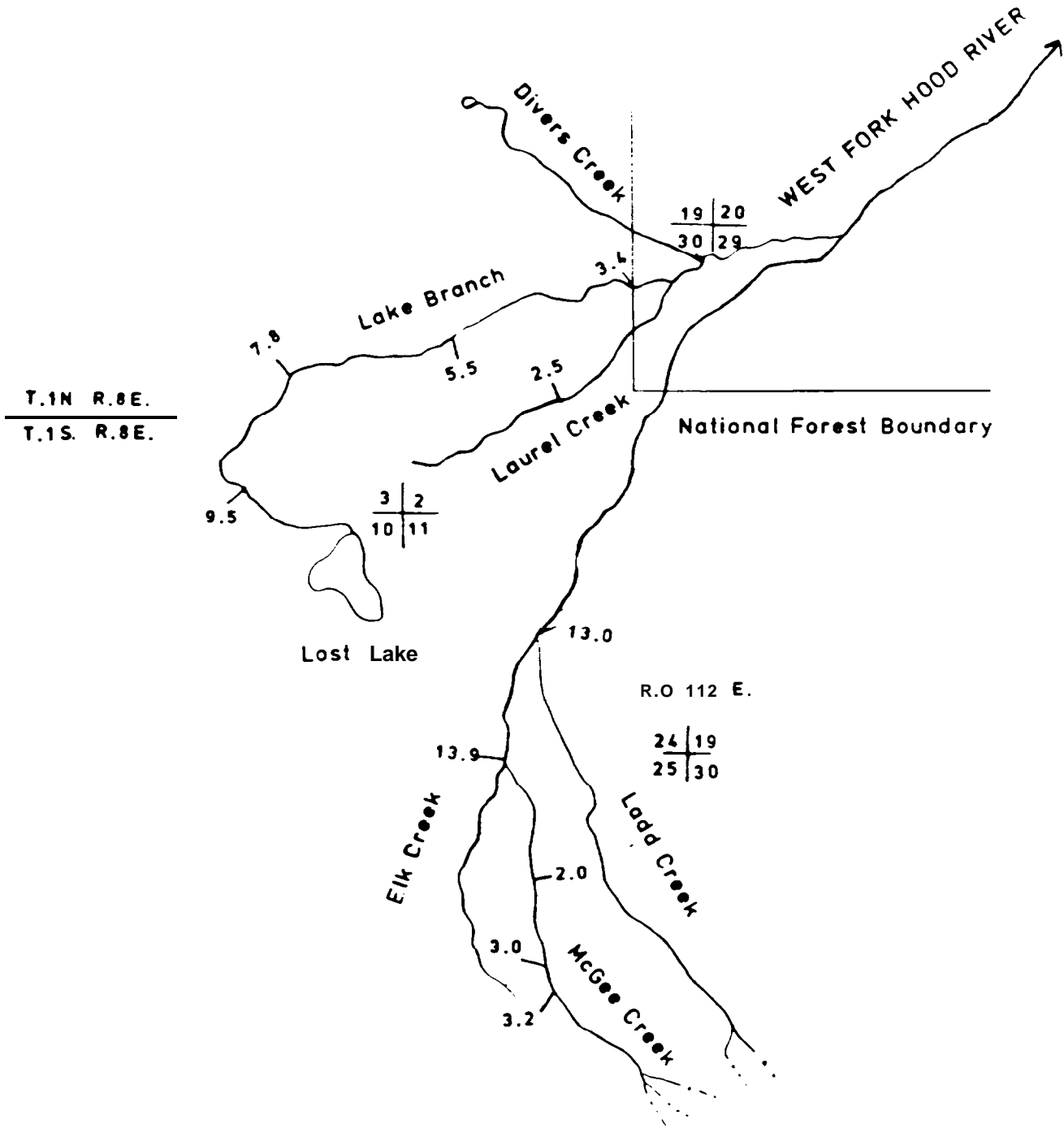
The focus of the Lake Branch habitat improvement project will be to increase habitat diversity from RM 3.4 to RM 7.8. Due to the amount of stream needing treatment, the approach will be to fall trees into the channel and anchor them in place with cable and epoxy resin. A large backhoe/excavator will be used to help place and anchor the trees. Introduction of large wood to the channel will address habitat deficiencies by providing cover, increasing low flow pool habitat, high flow quiet water sanctuaries, the amount of adult holding water, and the amount, placement, and distribution of spawning gravels. Specific tasks to achieve these objectives are identified in Section 2.

West Fork/McGee Creek Habitat Improvement. The confluence of McGee and Elk Creeks form the West Fork Hood River at RM 13.9. McGee Creek currently supports summer steelhead and there is potential habitat for spring chinook salmon. There is approximately 3.2 miles of potential steelhead habitat and about 3.0 miles that appears suitable for salmon production. The lower two miles of McGee Creek flows through private timber land, while the upper 1.2 miles of potential anadromous fish habitat is on National Forest land.

TABLE 1. Low flow rearing area by treatment reach within the West Fork Hood River drainage.

	Miles <u>Steelhead</u>	Miles <u>Chinook</u>	Average <u>Width(ft)</u>	Rearing Area(m <sup>2</sup> )	
				<u>Steelhead</u>	<u>Chinook</u>
Lake Branch (RM 3.4-7.8)	4.4	4.4	15	32,373	32,373
West Fork (RM 13.0-13.9)	.9	.9	20	8,829	8,829
McGee Creek (RM 0.0-3.2 Steelhead) (RM 0.0-3.0 chinook)	3.2	3.0	13	20,405	19,130
Laurel Creek (RM 0.0-2.5)	2.5	0	6	7,358	

FIGURE 3. WEST FORK HOOD RIVER  
 PROJECT AREA MAP  
 Approximate Scale 1/5 \* 1 mile  
 5.5.ect. Rivermile (RMI)



The West Fork Hood River flows through intermingled land ownership. The lower 9.5 miles of the West Fork flows through private timber land while the majority of the upper reaches flow through National Forest land with intermingled private timber holdings. Steelhead are the primary anadromous fish species inhabiting the West Fork. Spring chinook salmon are suspected of utilizing the West Fork, but their presence has not recently been documented.

Much of the West Fork Hood River lies in an inaccessible canyon and due to the magnitude of high flows there is little chance that hand installed structures will be effective. For these reasons, work in the West Fork will be located in the upper stream reaches (i.e. between RM 13.0 and 13.9). Access in this reach is still poor, but it will be possible to get heavy equipment to the stream. Due to lack of on-site materials, logs or boulders will need to be trucked to the site. Improvement work on the West Fork will focus on increasing cover and pool habitat to improve juvenile rearing conditions. Due to the logistic problems and intermingled land ownership, the West Fork will require planning and coordination with landowners and ODFW.

Like the West Fork, significant portions of McGee Creek flow through private land. It is anticipated that approximately 50 structures will be placed in the lower 3.2 miles of McGee Creek to increase habitat diversity by creating low flow pools, high flow refuge areas, adult holding water, cover, and increase the amount and distribution of spawning gravel.

The specific tasks to achieve these objectives in the West Fork and McGee Creek are outlined in Section 2. The budget estimate for the project is based upon the Forest Service performing the work on private lands as a subcontractor to ODFW.

Laurel Creek Habitat Improvement. Laurel Creek is a tributary of Lake Branch, entering Lake Branch at approximately RM 3.0. Laurel Creek appears to possess about 2.5 miles of potential steelhead habitat. Anadromous fish access is currently blocked by a series of small falls at the mouth.

Work in Laurel Creek will focus on providing passage at the mouth and improving low flow rearing habitat by creating pools and increasing cover. The improvement activities will need to be closely coordinated with ODFW, with ODFW taking the lead on the aspects of the project implemented on private land. Laurel Creek has not been surveyed recently, therefore actual implementation will depend upon passage feasibility and cost/benefit analysis. The tasks to achieve improvement objectives in Laurel Creek are outlined in Section 2.

## II. SPECIFIC PROJECT IMPLEMENTATION

The goal of the West Fork Hood River Basin Habitat Improvement Project is to improve low flow rearing habitat for summer steelhead and spring chinook on approximately 30% of the stream miles currently available to anadromous fish in the basin. This will primarily be accomplished through the introduction of large wood and boulder structure to increase pool, glide, and deep riffle habitats associated with good cover.

The following criteria were considered in selecting specific habitat improvement activities to resolve factors limiting fish production in the basin.

- Landowner acceptance and cooperation. Landowner acceptance and cooperation are necessary on private lands to implement project activities. Initial implementation under this plan will occur on National Forest land to allow for landowner contact on private land.
- Ability to complete projects. Implementing agency must have personnel, or capability to acquire personnel, necessary to complete tasks. Project work will commence on National Forest land because Forest Service has personnel on board to complete projects. Later implementation on private lands allows ODFW the opportunity to examine opportunities to implement projects on private lands, such as sub-contracting the work to the Forest Service.
- Logistic constraints. Project sites must be accessible to equipment for delivery of materials needed to meet project objectives.
- Potential benefits and costs. Projects have been selected to provide for the most immediate and long lasting benefits to fish production in the most cost effective manner available.

The following statement of work outlines activities from 1988 through 1991.

#### Summary of Tasks for the West Fork Hood River Basin Habitat Improvement

##### Objective 1: Lake Branch Habitat Improvement

##### 1988/1989 Tasks

Task 1.1 Complete final design, layout and contract preparation for 1988-89 project work.

Schedule: Begin about April 1, complete by May 31, 1988

Task 1.2 Implement 1988-89 project work. Fall and anchor approximately 115 trees to improve habitat diversity between approximately RM 5.5 and 7.8. Install eight engineered structures at RM 7.5.

Schedule: Begin August 1, end about September 31. 1988

Task 1.3 Maintain past project work to insure protection of investment and habitat objectives are being met. Little maintenance is anticipated.

Schedule: Begin about August 1, end about September 31.  
1988-1991

Task 1.4 Complete project planning for 1989-90 project work between RM 3.4 and 5.5. Treatment will include falling and blasting of trees and anchoring in channel to increase habitat diversity. Services of a consultant will be contracted to determine the feasibility of blasting trees into the channel.

Schedule: Begin about July 1, complete by December 1, 1988

Task 1.5 Continue monitoring program to measure effectiveness of structures at meeting habitat objectives and monitor population trends, Tasks include spawning surveys, adult resting hole counts ( pre and post project monitoring. On-going until project completion.

Schedule: Spawning surveys - April, 1988-1991

Resting hold counts - August & September 1988-1991

Pre and post project monitor - begin about July 15, complete by September 15, 1988-1991.

#### 1989/1990 Tasks

Task 1.6: Complete final design, layout and contract preparation for 1989-90 project work.

Schedule: Begin about April 1. complete by May 31. 1989

Task 1.7 Implement 1989-90 project work between RM 3.4 and 5.5. Project will include falling and blasting of trees into the channel to improve habitat diversity. as per recommendation of consultant.

Schedule: Begin about August 1, end about September 31, 1989

#### 1990/1991 Tasks

Task 1.8 Continue monitoring and maintenance of past projects as described in 1988-89 tasks.

Task 1.9 Complete "fine tuning" of project work to ensure all potential habitat improvement work has been completed. Possible examples would be enhancing cover associated with structures.

Schedule: Begin about July 15. end about August 31. 1990

#### 1991/1992 Tasks

Task 1.10 Complete monitoring and maintenance of project work as described in 1988-89 tasks. Prepare final project report.

Schedule: Begin April 1, complete by March 31, 1992.

Objective 2: West Fork/McGee Creek Habitat Improvement

#### 1988/1989 Tasks

Task 2.1 Continue baseline monitoring including spawning surveys in McGee Creek and upper West Fork, post project monitoring on McGee Creek, pre project Monitoring in upper West Fork and lower McGee Creek, post project monitoring as any project work is completed.

Schedule: Begin about April 1. complete field work by September 1. 1988-1991

Task 2.2 Begin initial planning work for upper West Fork/McGee Creek Habitat Improvement Project. Work includes coordination with Forest Service and ODFW, landowner contact by ODPW. feasibility analysis.

Schedule: Begin April 1988, on going through March 31, 1989

Task 2.3 Maintain structures completed in McGee Creek in 1986 as needed.

Schedule: If maintenance needed, work will be completed between July 15 and September 31. 1988.

#### 1989/1990 Tasks

Task 2.4 Continue baseline monitoring as described in 1988-89 tasks.

Schedule: Begin about April 1, complete field work by September 1, 1989

Task 2.5 Complete project planning and environmental analysis for West Fork/McGee Creek project.

Schedule: July 15 through October 1, complete environmental analysis by March 31, 1989.

Task 2.6 Continue maintenance as needed on 1986 McGee Creek project.

#### 1990/1991 Tasks

Task 2.7 Complete monitoring as mentioned in 1988-89 tasks. Include intensive habitat measurements in implementation reaches for pre-project reaches.

Schedule: Begin about April 1, complete pre-project measurements by July 15, 1990

Task 2.8 Complete final design, layout and contract preparation for 1990-91 project work.

Schedule: Begin about April 1. complete by May 31, 1990

Task 2.9 Implement 1990-91 project work. It is anticipated that in-stream structures will be placed in about three miles of stream.

Schedule: Begin about July 15, complete by October 15. 1990

Task 2.10 Continue maintenance of 1986 McGee Creek project if needed.

Schedule: Complete by October 15, 1990



#### 1991/1992 Tasks

Task 2.11 Complete baseline and post project monitoring. Prepare final report.

Schedule: About April 1, 1991, complete reports by March 31, 1992

Task 2.12 Maintain West Fork/McGee Creek projects as needed.

Schedule: Complete by October 15, 1991.

Objective 3 Laurel Creek Habitat Improvement

#### 1988/1989 Tasks

Task 3.1 Coordinate with ODFW and landowners, complete feasibility study of Laurel Creek project, include habitat surveys, determine potential benefits, estimate costs of passage.

Schedule: Begin in April 1988. complete by March 31. 1989.

#### 1989/1990 Tasks

Task 3.2 Coordinate with ODFW and landowners to develop implementation plan and environmental analysis for Laurel Creek Project. The services of a consultant will be contracted to develop passage alternatives.

Schedule: Begin in April 1989. complete March 31. 1990

#### 1990/1991 Tasks

Task 3.3 Pre-project monitoring of implementation reaches in Laurel Creek. Coordinate with ODFW.

Schedule: About July 15 - August 1, 1990

Tasks 3.4 Complete final design layout and contract preparation.

Schedule: Begin about April 1, complete by May 31, 1990

Task 3.5 Implement Laurel Creek habitat improvement project.

Schedule: Begin about August 1, complete by October 31. 1990

#### 1991/1992 Tasks

Task 3.6 Complete post project monitoring of Laurel Creek Project and monitor project as necessary.

Schedule Begin about July 15, end about August 31, 1991

## Coordination

All project work will need to be coordinated with ODFW. The coordination is especially important due to the intermingled private ownership. It is assumed in the costs breakdown, that ODE will sub-contract with the Forest Service to complete identified project work on private land. The reason for this is the Forest Service has people available to complete the work and Forest Service offices are closer to worksites. Landowner contacts will be conducted by ODFW. If ODFW decides to perform the work, funds requested in this Statement of Work will go to the State and not the Forest Service.

### III. FISH PRODUCTION INCREASES

When completed, the West Fork Hood River Basin Project is estimated to increase steelhead smolt production capacity by 1,748 to 3,816 smolts annually and increase spring chinook smolt production capacity by 1,309 to 16,290 smolts. The increase in smolt production should result in an increased adult return to the mouth of the Hood River of 140 to 305 adult steelhead and 65 to 815 chinook salmon (TABLES 2 and 3).

Rearing densities used for steelhead (TABLE 2) were obtained from the Hood River sub-basin planning "Presence/Absence Files" work sheets. The Technical Advisory Committee (TAC) estimated that the reaches of stream covered in this implementation plan currently contain fair steelhead habitat and thus are capable of rearing .05 SMOLTS/M<sup>2</sup>. It is felt that at completion of project work steelhead habitat quality will be increased to at least good and possibly excellent (.07-0.1 SMOLTS ). All project reaches will be receiving intensive treatment. The treatments should at least double available low flow pool/glide habitat volume for 1+ and older steelhead. Cover, spawning habitat, and adult holding habitat will also be increased. The production figures are similar to those used in calculating benefits for the Fifteenmile Basin Implementation Plan (Smith, et. al. 1987).

The calculated increases in spring chinook salmon (TABLE 3) were also formulated with the production figures used to complete the "Presence/Absence Files". The TAC determined that currently reaches of streams scheduled for treatment contain poor spring chinook habitat (.1 smolts/m ).<sup>2</sup> Project work should improve habitat quality to at least fair (.37 SMOLTS/M ). The improved habitat quality will be due to creating more available spawning habitat, an increase in low flow pool habitat and high flow quiet water refuge. The project work will also increase the amount of adult holding water and cover.

The low-end range of potential spring chinook production (.125 smolts/m<sup>2</sup> ) was calculated using the Mt. Hood National Forest smolt habitat capability index. The .125 smolts/m value would represent a 25% increase in smolt habitat capability. This figure is felt to represent the low range of potential production because all project reaches will be intensively treated. Completed project work should create an approximate 50:50 pool/riffle ratio and at least double current pool habitat.

TABLE 2. Estimated steelhead production increases resulting from implementation of the West Fork Hood River Drainage Habitat Improvement Project.

ANNUAL STEELHEAD SMOLT PRODUCTION CAPABILITY (#/square meter)						
	Low Flow Rearing Area	CURRENT	POST PROJECT Good Habitat		POST PROJECT Exlnt Habitat	
	<sup>2</sup> (m)	(0.05)	(0.07)	Increase	(0.10)	Increase
Lake Branch	32.373	1,618	2,266	(+648)	3.237	(+1618)
West Fork	8,829	441	618	(+177)	883	(+442)
McGee Creek	20.405	1,020	1428	(+408)	2040	(+1020)
Laurel Creek	<u>7,358</u>	<u>0</u>	515	(+515	736	(+736)
Totals		3079	4827	(+1748)	6896	(+3816)

ESTIMATED ANNUAL INCREASE IN ADULTS TO THE MOUTH OF HOOD RIVER

1748 smolts X .08 smolt to adult survival = 140 adults/year

3816 smolts X .08 smolt to adult survival = 305 adults/year

TABLE 3. Estimated annual spring chinook production increases resulting from implementation of the West Fork Hood River Drainage Habitat Improvement Project.

ANNUAL CHINOOK SMOLT PRODUCTION CAPABILITY (#/square meter)				
	Low Flow Rearing Area	CURRENT	POST PROJECT	
	(m2)	(0.10)	(0.37)	Increase
Lake Branch	32.373	3.237	11.978	(+8,741)
West Fork	8,829	883	3,267	(+2.384)
McGee Creek	<u>1.9130</u>	1,913	7,078	<u>(+5.165)</u>
Totals		6.033	22,323	(+16.290)

ESTIMATED ANNUAL INCREASE IN ADULTS TO THE MOUTH OF HOOD RIVER

16.290 smolts x .05 smolt to adult survival = 815 adults/year

#### IV. MONITORING

The Mt. Hood National Forest has had an on going fish habitat monitoring program. All stream reaches on National Forest Land covered by this Implementation Plan, except for Laurel Creek, were surveyed in 1987 to identify habitat quantity and quality. As treatments are completed the habitat will be resurveyed to determine changes due to rehabilitation work. Fish production by habitat type will then be estimated. A detailed explanation of the monitoring technique is presented by Hankin and Reeves (in publication).

In addition to the habitat surveys, spawning surveys will be continued on Lake Branch (RM 5.5-9.0). the West Fork Hood River (RM 13.0-13-g and McGee Creek (RM 0.0-3.2). Adult resting hole surveys will also be conducted on Lake Branch (RM 0.0-2.0). These surveys are being conducted to track population trends in the basin.

#### V. COSTS

TABLE 4 summarizes project costs by fiscal year. Detailed project budgets are presented in Attachment I, Budget. The proposed budgets probably represent the high range of cost estimates. Machine contract costs shown are based on the highest cost paid in past contracts. Maintenance costs are included but past experience has indicated that maintenance needs should be minimal. Personnel costs include labor and contract administration. It is assumed that most of the work will be completed using equipment rental contracts and Forest Service personnel will provide the labor and supervise contractors.

TABLE 4. Summary of project costs by year for implementation of the West Fork Hood River Habitat Improvement Project.

	Work Agreement Period			
	1988-89	1989-90	<u>1990-91</u>	<u>1991-92</u>
Implementation	340,485	536,405	\$81.310	85.650
Planning	6.340	6,458		
Monitoring	4.260	4.867	7.540	11.540
Overhead	3.080	3.236	4.039	1.439
Total	\$54,165	50,966	\$92.889	\$18,629

# 1988/1992 IMPLEMENTATION PLAN & WORN STATEMENT

## FISH/WASH CREEKS HABITAT IMPROVEMENT

### ADMINISTRATIVE SUMMARY:

Project Leader: Dave Heller Phone: (503) 666-0762

Project Number: 84:11. Subproject II

Project Period: April 1, 1988 - March 31. 1992

Project Headquarters: USDA Forest Service  
Mt. Hood National Forest  
2955 N.W. Division Street  
Gresham, OR 97030

Administrative Contact: Harv Forsgren Phone: (503) 666-0605

### I. INTRODUCTION

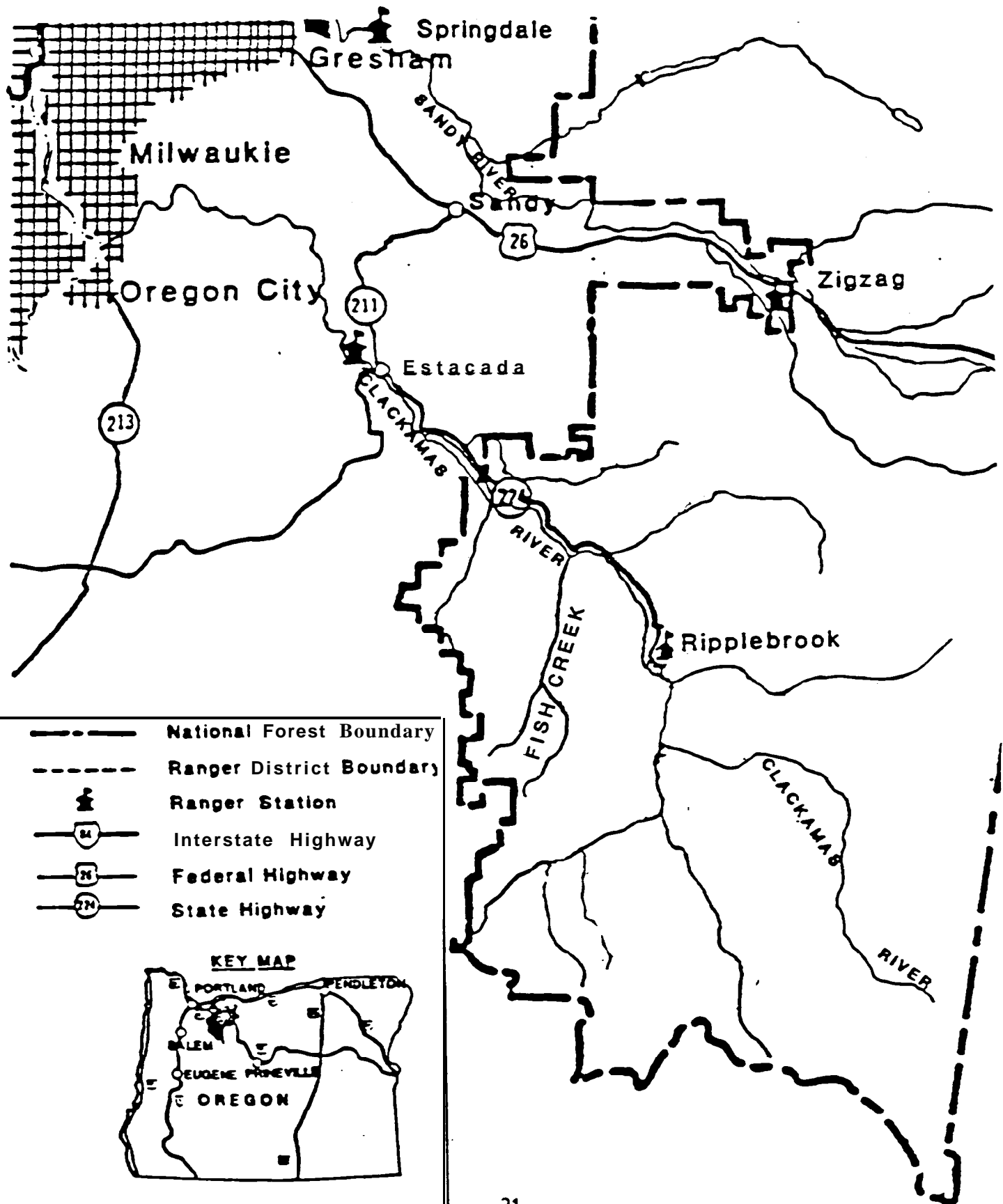
Fish Creek is a major tributary to the upper Clackamas River (FIGURE 4). The watershed is 13 miles long, averages approximately 6 miles wide, and covers 67 square miles of National Forest System lands. Fish Creek supports populations of spring chinook salmon, coho salmon, winter and summer steelhead trout, and resident trout.

Current fisheries habitat in Fish Creek is significantly different than it was historically. Surveys of the stream in 1959 indicated that approximately 45' of Fish Creek provided suitable rearing habitat for anadromous salmonids. Following the catastrophic flood flows of 1964, Fish Creek was resurveyed. The survey indicated that in 1965 rearing habitat represented only 25% of Fish Creek. The project leader conducting the survey concluded that this decrease in suitable rearing habitat was sufficient to "significantly limit" the salmon producing capabilities of Fish Creek (Sams 1965). Following the 1964 flood a vigorous log-jam removal effort was initiated and is probably responsible for a further decline in rearing habitat. Our studies from 1982 to 1986 indicate that pool habitat area in Fish Creek averaged only 10% of stream area prior to significant treatment (1982-1984), and has been increased to an average of almost 17% following treatment (1985-1986). Substantial additional increases in suitable rearing habitat area are anticipated from structure added to 3.5 miles of Fish Creek in 1987. The added structure resulted in a 113% increase in the number of pieces of large woody debris in the Fish Creek drainage.

Studies by Everest et. al. (1987). suggest that low flow rearing and overwinter habitat are indeed the "bottlenecks" limiting production of salmon and steelhead in Fish Creek. This conclusion is based on the observation that

FIGURE 4.

# VICINITY MAP FISH CREEK DRAINAGE





through the years 1982-86 estimated low flow population of young of the year (0+) steelhead in Fish Creek has been highly variable, while the estimated population of 1+ steelhead has remained relatively constant (TABLE 5).

This indicates that despite the level of seeding of 0+ steelhead, the present overwinter and low flow rearing habitat conditions can support approximately 22,000 1+ steelhead. Improving the overwinter and low flow rearing conditions in Fish Creek should increase the carrying capacity for 1+ steelhead. Coho salmon production also appears to be effected by the lack of quality overwintering habitat. Utilizing data from the two years the smolt trap has been in operation, estimates for overwinter survival of coho salmon juveniles was 31% survival in 1985 and 10% in 1986. The 31% is considered below average for western streams, and the 10% reflects the effects of a flood event in February 1986 (Everest et. al. 1987).

The Fish/Wash Creek project represents an ongoing, multi-year, cooperative effort to increase natural production of anadromous fish. The project was initiated in 1983, and is being jointly funded by BPA and the Mt. Hood National Forest. Five objectives have been identified for the project. They are: 1) increase rearing habitat for steelhead trout and coho salmon, 2) improve overwintering habitat for coho salmon and steelhead trout, 3) improve spawning habitat for spring chinook and steelhead trout, 4) rehabilitate riparian vegetation to improve stream shading to benefit all species, and 5) evaluate improvement projects on a drainage wide basis.

Project activities completed during the first three years of the program were typically prototypes to see which were most effective given the conditions found in Fish Creek. Project work included twenty-one boulder berms constructed to collect spawning gravels, and two perennial, one acre ponds created by diverting water from Fish Creek through pipes to intermittent, off-channel ponds. The ponds have quadrupled rearing habitat for coho salmon during low flow periods. Rearing and overwintering habitat was also increased by excavating an abandoned side channel and by falling a dozen "alcove trees" into the stream channel with dynamite. Four acres of riparian habitat were planted with fast growing cottonwood trees to promote stream shading.

Refined definition of limiting factors in 1985 increased the rate of project implementation and focused project emphasis on construction of complex log/boulder structures that promote optimal low flow rearing and overwintering habitat conditions. In 1986 about 110 structures were constructed at 2 work areas in lower and mid Fish Creek. A passage project was also completed at the mouth to improve access conditions for spring chinook. In 1987, approximately 400 structures were installed in 3.5 miles of the mainstem of Fish Creek, from RM 1.0 to 4.5. The structures included the addition of 579 pieces of wood to the stream channel. Rehabilitation efforts accomplished to date affect approximately 75% of the anadromous fish habitat in the Fish Creek drainage.

#### Management Objectives

The goal for anadromous fisheries management in the Fish Creek drainage is to restore and maintain optimal habitat conditions for the wild/natural production of spring chinook and coho salmon, and winter steelhead trout, and to evaluate the results of the improvement program on a drainage wide basis. To achieve this goal the management objectives are:

TABLE 5. Estimated numbers of 0+ and 1+ steelhead in Fish Creek, 1982-86.

Age	Year	1982	1983	1984	1985	1986	Avg.
	0+	87,710	60,030	88,060	115,770	117,870	93.888
	1+	21,680	26.990	23.260	18,520	20,670	22,224

1. General Habitat Improvement Strategy. To increase pool and glide habitat quantity and complexity (i.e. cover, configuration, and juxtaposition) through the reintroduction of large wood and rock structure to the stream.

2. Species Specific Habitat Strategy.

Steelhead. Implement project activities that provide preferred habitat with complex cover over the full range of seasonal conditions in Fish Creek.

1) Glide/deep water riffle and pool habitat for 1+ steelhead, especially for low flow, late summer periods.

2) Alcove/edge habitat for 0+ steelhead, especially for transition and winter periods.

Coho. Implement project activities that increase the amount and quality of slow water, sidechannel, offchannel, and edge habitats.

Spring Chinook. Implement project activities to assure low flow adult passage into the drainage, adult holding habitat, and overwinter habitat.

3. Evaluation Strategy. The objectives of the evaluation include:

1) Drainage wide evaluation and quantification of changes in salmonid spawning and rearing habitat resulting from a variety of habitat improvements.

2) Evaluation and quantification of changes in fish populations and biomass resulting from habitat improvements.

3) Benefit-cost analysis of habitat improvements developed with BPA and Forest Service funds on Fish Creek.

## II. PROJECT IMPLEMENTATION

The management objectives presented above are reflected in the Fish Creek Drainage Enhancement Plan developed by the Forest and ODFW (Hohler 1987). The plan identifies all improvement project sites and applications in the drainage, identifies priorities and schedules the work into annual projects. This implementation plan/statement of work presents the remaining tasks of that plan. The actions proposed for implementation are consistent with measure 703(c) of the Northwest Power Planning Council's Fish and Wildlife Program and the proposed Mt. Hood National Forest Land Management Plan. Development of this implementation plan and statement of work has been coordinated with and reviewed by the ODFW District Biologist and Portland General Electric biologist with responsibility for the Clackamas River drainage.

### Implementation Criteria

The following criteria were considered in selecting specific habitat improvement activities to address limiting factors for anadromous fish production within the watershed:

1. Cost/benefit. Based on several years of implementation experience on the Forest, habitat improvement activities selected for Fish Creek include those that provide the most immediate and long lasting benefit to fish production capability in the most cost effective manner available.
2. Location within the basin. Activities are to be initiated in the lower stream reaches and proceed upstream to allow full utilization of woody debris introduced during improvement activities.
3. Logistic constraints. The availability of on-site materials, or access to bring in materials, is an important consideration in selecting techniques and locations for habitat improvement.
4. Treatment intensity. As a minimum, treatment in Fish Creek is to include one large tree per 50 lineal feet of stream channel. Treatment intensity in the 1986 project area averages one structure per 36 lineal feet. Based on subsequent review it is felt that this treatment provided the physical changes expected, but that increased treatment intensity would have resulted in additional habitat benefits. Emphasis will be on multi-log structures. These structures appear to provide the greatest habitat changes and stability in the stream channel.

#### Summary of 1988/1989 Tasks

1. Implement treatment of 1.5 miles of stream in the Fish Creek drainage. This effort will be concentrated in the last mainstem work area, from river mile (RM) 6.2 to 6.7 on upper Fish Creek and on Wash Creek from BM 0.0 to 1.0. (FIGURE 5)
  - 1.1 Prepare equipment rental, boulder haul, and tree felling contracts for advertisement and award.

Schedule: Complete contract preparation by January 1, 1988, award by April 1, 1988.
  - 1.2 Implement boulder haul contract, delivering approximately 100 large boulders to the treatment sites.

Schedule: Begin May 1, complete July 1, 1988.
  - 1.3 Fall a minimum of 50 "alcove" trees to provide slow water habitat along the stream margins. The development of margin habitat will be significantly expanded in this year of implementation.

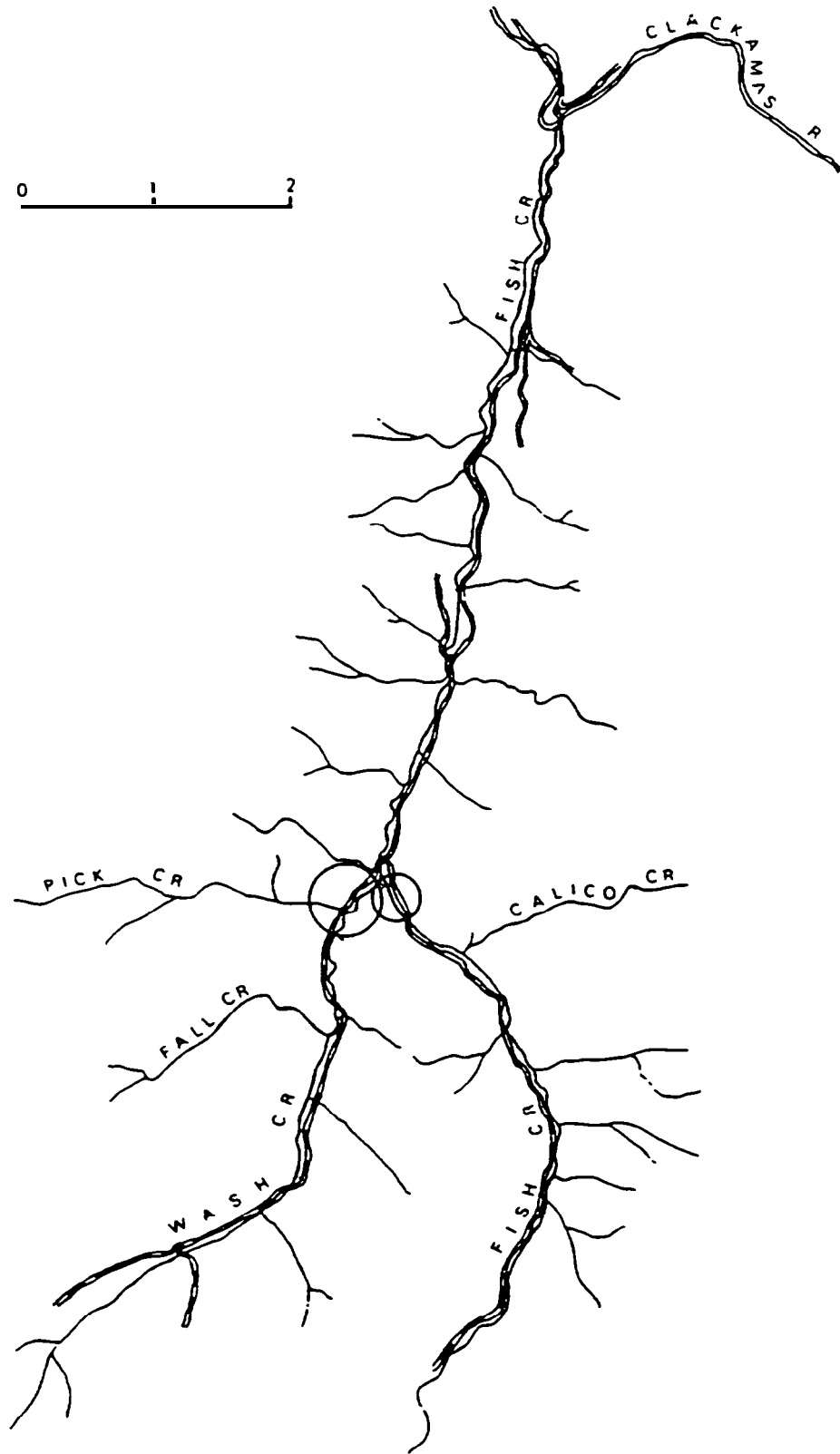
Schedule: Begin June 1, complete July 1, 1988.
  - 1.4 Fall at least 100 trees to be used in the construction of log/boulders complexes.

Schedule: Begin June 1, complete July 1, 1988.
  - 1.5 Implement equipment rental contract, using a large track mounted or walking backhoe to position the logs and boulders into the planned

# FISH CREEK PROJECT AREA

FIGURE 5.

1988/89



structures. Boulders located along the banks of the project area will also be used and will be picked up when the backhoe is operating. The boulders will be placed individually and in groups to act as scouring agents in riffles, to provide cover in pools, and to act as anchoring points for LWD.

Schedule: Begin July 1, complete October 1, 1988.

1.6 Complete anchoring of structures. Once the backhoe is removed from the site a four or five person crew will be used to anchor the felled trees to the boulders. The anchoring system to be used employs a gas powered pneumatic drill and a polyester resin. Two 10" deep holes are drilled into the boulder and filled with the polyester resin. One end of the cable (1/2"-3/4" diam.) is inserted into one hole and the cable is wrapped around the log and the other end is inserted into the other hole. The resin takes a few minutes to set up and can bear a full load in approximately one and one-half hours. The cut end of the log will be cabled to standing trees and/or stumps with 1/2" cable and cable clamps.

Schedule: Begin August 1. complete November 1. 1988.

2. Continue the Fish Creek evaluation with combined BPA/Forest Service funding. Evaluation objectives are identified above. Included this year is evaluation of overwintering survival and movement of pre-smolts in the basin. Estimates of smolt production and/or smolt survival will be made in conjunction with the Fish Creek evaluation.

2.1 Habitat/Fish Survey. The intensive survey of existing and potential spawning and rearing habitat will be continued in 1988-89. Measurements include bank full channel width and depth; classification of habitat by habitat unit: riffles, pools, glides and beaver ponds; water surface area and volume; frequency and size of point bar formations or pockets of gravel accumulations; and frequency and size of erosion cuts in the channel banks. Rearing habitat will be determined from the above surveys by focusing on the volume of pools, frequency of pools, and area and volume of side channel rearing. In order to evaluate the success of the proposed and completed enhancement projects, we will have to determine the densities, biomass, and size distribution of the various species of salmonids.

Snorkel surveys are completed in every 5th habitat unit and electrofishing in every 20th habitat unit. A three-pass removal method will be used for population estimates. Fish collected from each site will be anesthetized with MS 222 (tricaine methanesulfonate!), identified to species, measured for fork length, weighed, and allowed to recover before release. Density, biomass, and species distribution will be related to the major features of the habitat units.

2.2 Smolt Quantification. Successful habitat improvements for anadromous salmonids must increase smolt production from the treated basin. Past evaluation efforts have estimated smolt production as a percentage of the late summer standing crop of pre-smolts in the treated area or basin. Such estimates can be grossly in error, especially if winter

habitat is limiting survival of pre-smolts, and lead to erroneous conclusions regarding project success. Pre-smolt to smolt survival rates are generally lacking for all species of anadromous salmonids in the Columbia basin and are urgently needed for evaluation of habitat improvement projects. Smolt trapping on Fish Creek will yield over winter survival rates for coho salmon and steelhead trout which can then be extrapolated to similar habitats in the basin. This task will entail operating the smolt trap near the mouth of Fish Creek from mid March to mid June during the evaluation period. The smolt trap may be fished longer than this depending on the water conditions.

- 2.3 Wood Structure Monitoring. Log structures/debris in Fish Creek were mapped in Fall 1986 and 1987 so movement and performance of individual structures can be monitored after freshets and flood events. All the habitat improvement structures and naturally occurring pieces larger than 16 feet in length and 1 foot in diameter were tagged with consecutively numbered plastic tags (four per piece of wood). The placement of each structure is mapped in 330 foot reach increments, and the volume and orientation of each piece is recorded. The proportion of each piece wetted at low and high streamflows will also be recorded. Results of the wood tagging study will allow evaluation of the stability of complex habitat improvement structures and, in conjunction with USDA FS funded companion tagging project of naturally occurring woody debris in the system, allow comparison with the stability of naturally occurring wood in streams of different width and order.
- 2.4 Intensive Evaluation of Habitat Complexity Increases. This work item will concentrate on quantifying the shift in habitat units as a result of the habitat improvement work completed in 1986. This will involve a more intensive physical and biological sampling effort than has been followed to date on Fish Creek. The improved section of Fish Creek will be compared with adjacent unimproved sections to quantify the changes in habitat complexity and utilization. General habitat units will be broken down into subunits to determine the effects of increasing complexity/dispersion of smaller units such as pocket pools. These smaller units will then be sampled to determine salmonid density and numbers.
- 2.5 Spawning Gravel Utilization. Spawning gravel resources throughout the anadromous portion of Fish Creek will be resurveyed during the spring of 1988. Preliminary observations indicate that substantial increases in spawning gravel have been realized in much of the Fish Creek drainage. The extent to which this is an actual increase, rather than a resorting of existing resources can be determined after the survey. In addition, five 0.6 mile stream reaches below the falls will be established. These spawning gravel transects will be surveyed twice a month for 5 months beginning in October and ending in mid-May. The survey will tally adults observed by species and sex, and count the number and record the location of redds within the sample reaches. This will allow evaluation of the utilization of newly generated spawning gravels by anadromous fish.
- 2.6 Winter Habitat Utilization. Successful habitat improvement in the

Fish Creek basin depends on an adequate knowledge of factors limiting fish production at all seasons of the year. Present evaluation efforts have clarified salmonid habitat utilization in summer and have identified key habitat types that limit summer production of juvenile steelhead trout and coho salmon in the basin. Preliminary observations of winter habitat availability and utilization in 1984-85 have indicated that winter might pose greater limitations on rearing juvenile salmonids in Fish Creek than any other season. It appears from diving observations that nearly all habitat in Fish Creek is used by steelhead and coho in summer, but as little as 10 percent might be suitable for use by overwintering salmonids. Good winter habitat appears to be highly specialized, consisting of specific habitat types at specific depths and velocities. Intensive winter habitat surveys are needed to determine the relative importance of factors limiting salmonid production in winter. When this knowledge is available, habitat improvement in Fish Creek and other similar basins can be aimed directly at known limiting factors, greatly diminishing the risk of project failures.

- 2.7 Continuing Miscellaneous Items. Beaver Ponds #1 & 2 - (a) Estimate growth, survival, immigration, and emigration of salmonids. (b) complete food habits study and nutrient analysis of pond, and (c) complete maintenance on trap and ladder. Side Channel (lower) - (a) Complete physical map of channel cross sections, thalweg. large woody debris, and spawning gravel, and (b) estimate fish populations quarterly.
- 2.8 Coded Wire Tagging. Coho salmon smolts leaving enhanced and natural habitats in Fish Creek were tagged with coded wire tags beginning in 1987. This tagging will continue through 1991. Approximate cost of this program, after purchase of the tagger is \$8,450 per year. This effort will provide survival estimates of coho smolts from natural and enhanced habitats. contribution of coho from natural and enhanced habitats to commercial fisheries, and distribution of Fish Creek coho at sea.

Schedule: Begin April 1. 1988, complete for year March 31, 1989.

3. Perform necessary maintenance of habitat improvement structures.

3.1 Perform inspections to identify maintenance needs.

Schedule: Begin April 1. complete May 1, 1988.

3.2 Implement maintenance activities in conjunction with habitat improvement activities.

Schedule: Begin July 1, complete October 1, 1988.

4. Prepare annual report and work statement/budget modifications, including design and plan of activities to "refine" and complete implementation of rehabilitation efforts in the Fish Creek Drainage. This will include a peer review of the drainage by Forest Service, ODFW and PGE biologists.

Schedule: Begin November 1, 1988, complete March 31. 1989.



### Summary of 1989/1990 Tasks

1. Implement activities to maintain, refine, and complete rehabilitation of the Fish Creek drainage. These activities will consist of maintenance on previous structures and additional work in all project areas that is shown to be most cost effective. This will be determined by post project evaluation of the physical and biological functioning of structures installed over the project life. If a particular technique is identified as being especially effective, and additional opportunities exist to employ it in the range of project areas, implementation of additional structures will be pursued. Planned "refinement" of implemented work includes placing additional woody structure to enhance cover characteristics, anchoring structures at additional points to maximize structure longevity, and armoring stream banks where flow is deflected toward easily errodable banks.

1.1 Prepare equipment rental, boulder haul. falling contracts for advertisement and award.

Schedule: Complete contract preparation by January 1, 1989, award by April 1, 1990.

- 1.2 Implement measures to refine treatment of Fish Creek drainage if additional opportunities have been identified as particularly effective and cost efficient through the range of project areas. (See above description of planned activities.)

Schedule: Begin July 1, complete October 1. 1989.

2. Continue basin evaluation as outlined in Task 2 for the 1988-1989 agreement period.

Schedule: Begin April 1, 1989, complete for the year March 31, 1990.

3. Perform necessary maintenance of habitat improvement structures.

3.1 Complete inspection to identify maintenance needs.

Schedule: Begin April 1, complete May 1, 1989.

3.2 Perform required maintenance.

Schedule: Begin July 1, complete October 1. 1989.

4. Prepare annual report and work statement/budget modifications.

Schedule: Begin November 1, 1989, complete March 31, 1990.

### Summary of 1990/1991 Tasks

1. Implement Basin Evaluation as described in Task 2 for agreement period 1988/89.

Schedule: Begin April 1, 1990. complete for year March 31, 1991.

2. Perform necessary maintenance of habitat improvement structures.

2.1 Complete inspection to identify maintenance needs.

Schedule: Begin April 1, complete May 1, 1990.

2.2 Perform required maintenance.

Schedule: Begin July 1, complete October 1, 1990.

3. Prepare annual report and work statement/budget modifications.

Schedule: Begin November 1, 1990, complete March 31, 1991.

#### Summary of 1991/1992 Tasks

1. Implement Basin Evaluation as described in Task 2 for agreement period 1988/89. (Note some evaluation tasks are complete and therefore dropped in this agreement period)

Schedule: Begin April 1, 1991, complete March 31, 1992.

2. Prepare annual report (and work statement/budget modifications pending outcome of sub-basin planning process).

Schedule: Begin November 1, 1991, complete March 31, 1992.

### III. FISH PRODUCTION INCREASES

The status of smolt production in the Fish Creek drainage varies by species. Spring chinook salmon primarily use Fish Creek as a spawning site. Upon emergence most of the fry drop downstream into the Clackamas River and North Fork Reservoir to rear. Therefore, no smolt production estimate has been made for spring chinook salmon. Winter and summer steelhead trout are near full seeding of available rearing habitat. Increased steelhead production would result from creation of additional rearing habitat or increased survival by improving the quality of existing rearing habitat. Coho salmon are currently somewhat under seeded in Fish Creek. Additional increases in coho production would result from habitat improvement in accessible areas. Additional production of salmon and steelhead could also be realized by increasing overwinter survival.

Utilizing data from the PNW evaluation on Fish Creek, smolt production increases resulting from the proposed 1988-92 project can be estimated based on the following assumptions: 1) the average low flow **surface** area of anadromous fish habitat in Fish Creek, from 1982-86. was  $181,500 \text{ m}^2$ , 2) Fish Creek on an annual basis currently produces 8,000 steelhead smolts and 2,600 mainstem coho smolts (excludes production from the off channel ponds), and 3) the 1988-89 and 1989-90 project areas represent 20% and 13% respectively, of the anadromous habitat in Fish Creek. Given these **assumptions**, current steelhead smolt densities in Fish **Creek** are  $0.044 \text{ Smolts/m}^2$  and mainstem coho smolt densities are  $0.014 \text{ smolts/m}^2$ . These are below the smolt/habitat capabilities

developed on the Mt. Hood National Forest for Fish Creek following treatment. With intensive ~~treatment~~<sup>2</sup>, Fish Creek ~~should~~<sup>2</sup> be able to produce at least 0.075 steelhead smolts/m<sup>2</sup> and 0.036 coho smolts/m<sup>2</sup>, resulting in an increase in smolt production of 1,857 steelhead and 1,317 coho smolts annually (TABLE 6).

#### IV. MONITORING AND EVALUATION

The Fish Creek evaluation being conducted by PNW is the most comprehensive evaluation of habitat improvement projects in the Columbia River basin. The drainage-wide approach taken in this evaluation effort will provide meaningful results that will guide future enhancement in the Clackamas River drainage and elsewhere in the Columbia River basin. Additional detail regarding the monitoring and evaluation program may be found in chapters I and II of this document or the BPA Annual Accomplishment reports published since 1985.

#### V. COSTS

Projected project costs are summarized by fiscal year and major task in TABLE 7. Detailed annual project budgets are included in Attachment I, Budget.

TABLE 6. Estimated increase in smolt production resulting from the 1988-92 enhancement project.

Species	Project Area (m <sup>2</sup> )	Current		Post Project		Increase
		Density	Number	Density	Number	
Steelhead	59.900	0.044/m <sup>2</sup>	2,636	0.075/m <sup>2</sup>	4,493	+1,857
Coho	59.900	0.014/m <sup>2</sup>	839	0.036/m <sup>2</sup>	2,156	+1,317

TABLE 7. Summary of proposed expenditures by fiscal year and implementation task for the Fish/Wash Creeks habitat improvement project.

Major Task	Work Agreement Period			
	1988-89	1989-90	1990-91	1991-92
<u>Direct Costs</u>				
1. Design/Implement	45.625	20,655		
2. Evaluate	46.734	46.734	46,734	31,310(*END*)
3. Maintenance	10,750	10.750	10,750	*END*
<u>Indirect Costs</u>				
1 Overhead	3.579	1,978	630	
TOTAL COSTS	\$106.688	80.117	58.114	31.310

\*ND\* Actual end of Evaluation and Maintenance tasks to be negotiated with BPA.

## 1988/91 IMPLEMENTATION PLAN & WORE STATEMENT

### COLLAWASH FALLS FISH PASSAGE

#### ADMINISTRATIVE SUMMARY:

Project Leader: Dave Heller Phone: (503) 666-0762

Project Number: 84:11. Subproject III

Project Period: April 1, 1988 - March 31. 1991

Project Headquarters: USDA Forest Service  
Mt. Hood National Forest  
2955 N.W. Division Street  
Gresham, OR 97030

Administrative Contact: Harv Forsgren Phone: (503) 666-0605

#### I. INTRODUCTION

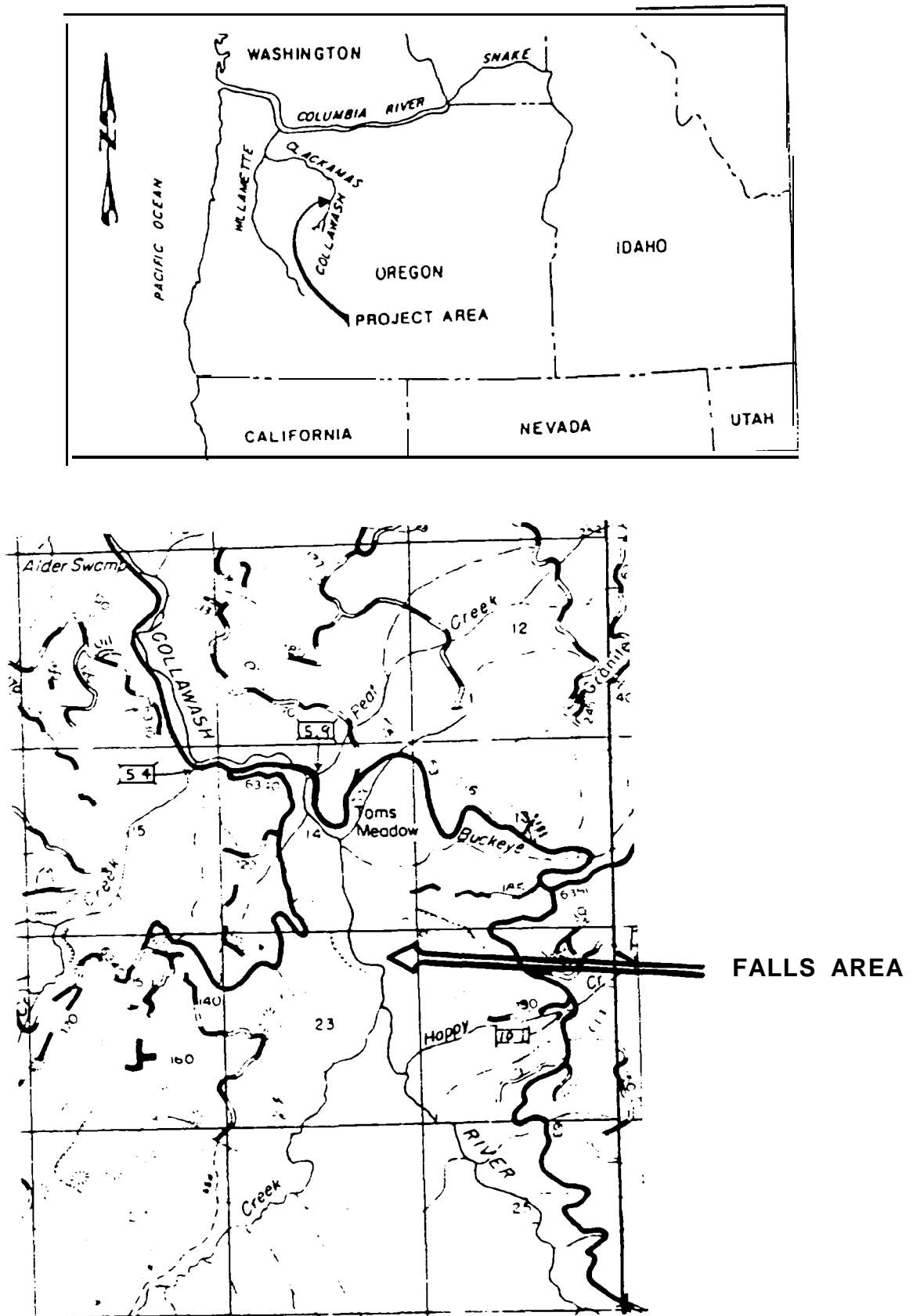
The Collawash River is the largest headwater tributary of the Clackamas River. Hainstem length is 11.6 miles and the basin area is 150 square miles (FIGURE 6). It provides approximately one third of the low flow volume of the upper Clackamas River. The Collawash River drainage is entirely on National Forest System lands. Fish habitat is rated generally good to excellent throughout the drainage. Current management emphasis is to increase naturally reproducing runs of spring chinook and coho salmon and steelhead trout, while maintaining selected, naturally blocked tributary streams for wild trout production.

Depending on flows during migration, a 12-15 foot falls at RM 7.4 (T7S. R6E. Sec. 23) is a partial to full barrier to upstream passage of anadromous fish. The falls block access to about 10 miles of excellent habitat. Of particular importance is the 10,000-12,000 square yards of high quality spawning gravels above the falls. The falls are located in a deeply incised gorge making access and working conditions difficult. In 1974-1975 the Forest Service invested more than 840,000 to improve fish passage at the falls and several upstream cataracts. The effort was partially successful, and full passage was provided over the upstream cataracts, but work on the falls was stopped after one season due to concerns over safety and design feasibility.

Passage of anadromous fish over Collawash falls continued to be an important but unfinished fisheries habitat improvement project. Given the amount of suitable anadromous fish spawning and rearing habitat above the site, completing the project and providing full passage has excellent potential to be highly cost effective.

In 1984 BPA funded resumption of the effort to establish fish passage at Collawash Falls. A project feasibility report was completed by Ott Water Engineering in January 1986 (Medel 1987). The report identified four passage

FIGURE 6. Project location map for Collawash Falls passage improvement



alternatives including raising the tailwater and structural and non-structural modifications to the lower falls. Mt. Hood National Forest personnel identified weir/pool development as the preferred alternative. An environmental assessment documenting the decision was completed in March of 1986. Through the balance of 1986 a design and construction contract package was developed. This package was advertised in May of 1987. Following a non-responsive bid period, a series of meetings resulted in a decision to pursue implementation of the fish passage project with Forest Service fish passage specialists from Alaska.

The Alaska fish passage team provided the final design, construction staking, blasting expertise, and personnel to provide supervision of work activities. Work force laborers consisted of Clackamas Ranger District personnel and three Job Corpsmen from the Timber Lake Job Corp Center. Additionally, two personal services contracts were advertised and awarded to two drill operators with blasting experience. A helicopter was used to ferry construction equipment and materials to the site. Implementation of Phase I of the construction of the fish passage facility was initiated in August 1987. Phase I provided for the excavation of a trench in the bedrock face of the falls that is approximately 95 feet long, 8 feet deep and 10 feet wide. Other activities accomplished during the 1987/88 agreement period included a release of 10,000 coho presmolts by ODFW above the falls (note: chinook and or coho presmolts have been stocked above the falls since 1985 to establish runs of fish returning to the upper Collawash River system). processing of reports, and final project site design plans for Phase II implementation.

Activities planned for the 1988/89 work agreement period will focus on implementation of Phase II of fishway construction. A headwall control structure and six weirs will be placed in the excavated trench to complete construction of the fish passage facility. Construction will be supervised by the project engineer from Alaska. Timber Lake Job Corpsmen will be scheduled to assist District employees in construction of concrete forms and pouring and finishing the concrete. One or more personal service contracts may be required to add necessary experience to the 10.8. Visual observations at the falls and spawning ground counts will be conducted to monitor the presmolt outplant returns.

Observation of passage facility function and adult fish utilization will be initiated during the 1989/90 work agreement period and continued through the life of the facility. Required "fine tuning" of the fishway will be scheduled for 1990-1991. This will include constructive modifications of specific facility components (headwall/training wall, weirs, pool depths) to provide full fish passage at all flows. Necessary maintenance will be performed in 1989/90 and 1990/1991 to repair possible high flow damages to the passage facility.

Out-year project emphasis areas will concentrate on coordinated efforts with ODF&W, PGE and BPA to identify and address all opportunities to increase the naturally reproducing runs of spring chinook and coho salmon and steelhead trout of the Collawash River drainage. Measures applied will be consistent with those described and approved in the Clackamas River sub-basin planning process.



## Management Objective

The current goal for anadromous fisheries management in the Collawash River drainage is to provide returning adult fish year-round access past the migration barrier at RM 7.4 to the extensive upstream areas of suitable spawning and rearing habitat. Native run winter steelhead, coho and chinook salmon are the primary benefitting target species.

## II. PROJECT IMPLEMENTATION

### Summary of 1988/1989 Tasks

1. Implement Phase II of passage facility construction.
  - 1.1 Complete assemblage of all necessary project vehicles, equipment and materials.  
Schedule: Begin January 1, complete by August 1, 1988.
  - 1.2 Coordinate recruitment and scheduling of project work crew and project assignments.  
Schedule: Begin November 1, 1987, complete by August 1, 1988.
  - 1.3 Develop contracts for helicopter airlift of materials and equipment to and from project work site.  
Schedule: Begin March 1, complete by July 1, 1988.
2. Implementation of Phase II of the construction (i.e. setting of headwall and weirs).  
Schedule: Begin August 1, complete by September 30, 1988.
3. Monitor returns of chinook salmon from 1985 presmolt plant via visual observations at the falls and upstream spawning grounds.  
Schedule: Begin about August 1, complete by March 1, 1988.
4. Identify need for maintenance of fish passage structure.  
Schedule: Begin about May 1, 1989.
5. Prepare annual report and work statement/budget modifications.  
Schedule: Begin about November 1, complete by March 31, 1989.

### Summary of 1989/1990 Tasks

1. Provide for maintenance of the passage facility.  
Schedule: Begin July 1, complete by August 1, 1989.

2. Monitor facility performance and utilization of upriver spawning habitat.

Schedule: Begin August 1, complete by March 1, 1989.

3. Identify additional maintenance needs for fish passage facility and/or need to modify fishway design.

Schedule: Begin October 1, 1989. complete by March 31, 1990.

4. Prepare annual report and work statement/budget modifications.

Schedule: Begin November 1, 1989 complete by March 31, 1990.

#### Summary of 1990/1991 Tasks

1. Provide for maintenance (and modification if necessary) of the passage facility.

Schedule: Begin July 1, complete by September 1, 1990.

2. Monitor returns of presmolt outplants and utilization of upriver spawning habitat.

Schedule: Begin August 1, complete by March 1, 1990

#### Coordination Efforts

The development of this implementation plan and statement of work has been coordinated with and reviewed by the ODFW District Fisheries Biologist with responsibility for the Clackamas River drainage. Completion of the passage facility at Collawash Falls highlights the need for continued coordination efforts between management agencies.

The Forest Service, ODFW, and BPA. as well as public groups (Oregon Trout, Salmon and Steelhead Anglers of Oregon) are committed to increasing the naturally reproducing runs of anadromous fish throughout the Columbia River basin. The sub-basin plan for the Clackamas River, when completed, will emphasize this management objective for the Collawash River. The Mt. Hood National Forest is currently cooperating with PGE and ODEW in a native coho salmon population monitoring effort that includes outplanting of smolts in the upper Collawash River.

### III. FISH PRODUCTION INCREASES

Estimates of fish production increases resulting from improved passage at Collawash Falls are over 55,000 smolt or about 3000 ocean adults per year. These estimates are based on: 1) area of suitable habitat above the falls: 2) assumed smolt production capabilities, and; 3) assumed smolt to adult survival

ratios. These habitat, production, and survival coefficients are summarized below.

1. Bypass facilities at Collawash Falls will make available:

<u>Stream</u>	<u>Length</u> (m )	<u>Avg. Low Flow Width</u> (m)	<u>Total</u> (sq. $\square$ )
Mainstem Collawash	8.1	7.6	61,316
Dickey Creek	<del>1.6</del>	<del>2.4</del>	3,924
East Fork	0.6	4.6	22,074
Elk Lake Creek			2,943
<hr/>			
TOTAL	15.1		90,297

2. Potential production by species (based on Forest smelt/habitat capability estimates):

Steelhead: 0.075 smolt/square meter X 90.92 sq m = 6,772 smolt  
 Chinook: 0.260 smolt/sq meter = **23.477** smolt  
 Coho: 0.280 smolt/sq meter = 25,283 smolt

TOTAL SMOLT = 55.532/year

3. Existing production, based on ODFW/FS estimates:

Steelhead: 25 escaping adults (from 500 smolt)

4. Annual increased production equals potential production minus existing production, multiplied by the survival rate for smolt to adult:

Steelhead: (6772 - 500 smolt) X 0.1 (smolt to adult) = 627 adults  
 Chinook: 23.477 smolt X 0.04 (smolt to adult) = 939 adults  
 Coho: 25,283 smolt X 0.055 (smolt to adult) = 1391 adults

TOTAL OCEAN ADULTS = 2957/year

#### IV. MONITORING

Monitoring of passage facility utilization and performance will be conducted by visual observation throughout the life of the fishway. Annual surveys of upriver and tributary stream spawning habitat and anadromous fish redds counts will also be conducted.

#### v. COSTS

Projected project costs are summarized by fiscal year in TABLE 8. Detailed annual project budgets are included in Attachment I, Budgets.

TABLE 8. Summary of proposed expenditures by fiscal year for the Collawash Falls fish passage project.

	1988-89	1989-90	1990-91	Total
Direct Costs	862,272	\$ 7,600	512,600	\$82,472
Indirect Costs	\$ 4.890	\$ 912	\$ 1,512	<b>7314</b>
Yearly Total	\$67.162	\$ 8,512	\$14,112	\$89,786

## 1988/1991 IMPLEMENTATION PLAN & WORK STATEMENT

### HOT SPRINGS FORK, COLLAWASH RIVER HABITAT IMPROVEMENT

#### ADMINISTRATIVE SUMMARY:

Project Leader: Dave Heller Phone: (503) 666-0762

Project Number: 84:11. Subproject IV

Project Period: April 1, 1988 - March 31. 1992

Project Headquarters: USDA Forest Service  
Mt. Hood National Forest  
2955 N.W. Division Street  
Gresham. Oregon 97030

Administrative Contact: Harv Forsgren Phone: (503) 666-0605

#### I. INTRODUCTION

The Hot Springs Fork of the Collawash River is a fourth order tributary joining the Collawash at river mile (RN) 4.0 and provides one-third to one-half of the low flow of the main river (FIGURE 7). A mainstem length of 10.6 miles drains a 60 square mile basin. The entire watershed is on National Forest System lands. The Hot Springs Fork supports winter and summer steelhead trout, spring chinook. and coho salmon.

Fisheries habitat in the Hot Springs Fork, like most of the streams in the Clackamas River drainage, probably varies significantly from what it was historically. Surveys of Roaring River and Fish Creek, two tributaries to the Clackamas, conducted in 1959 indicated that approximately 45% of Fish Creek and 29% of Roaring River consisted of rearing habitat. A resurvey of the same areas in 1965, following the catastrophic flood of 1964, indicated that only 25% of Fish Creek and 7% of Roaring River was rearing habitat. These surveys also indicated that approximately a third of the spawning habitat in Fish Creek had been lost. One of the conclusions reached by the project leader heading the survey effort is that the greatest damage to fish habitat in Fish Creek and Roaring River was the loss of rearing habitat, and that this change was sufficient to "significantly limit the salmon producing capabilities of these streams" (Sam 1965). It is apparent that the 1964 flood had similar impacts on habitat composition and quality in the Hot Springs Fork.

Based on preliminary findings of the Fish Creek evaluation, it appears that the factors limiting anadromous production in Hot Springs Fork are related to the loss of structure and pool habitat resulting from the 1964 flood and subsequent debris removal efforts. Rearing habitat quantity and quality appear to be limiting coho and steelhead production in the Hot Springs Fork (TABLE 9).

FIGURE 7.

# VICINITY MAPS

## HOT SPRINGS FORK DRAINAGE

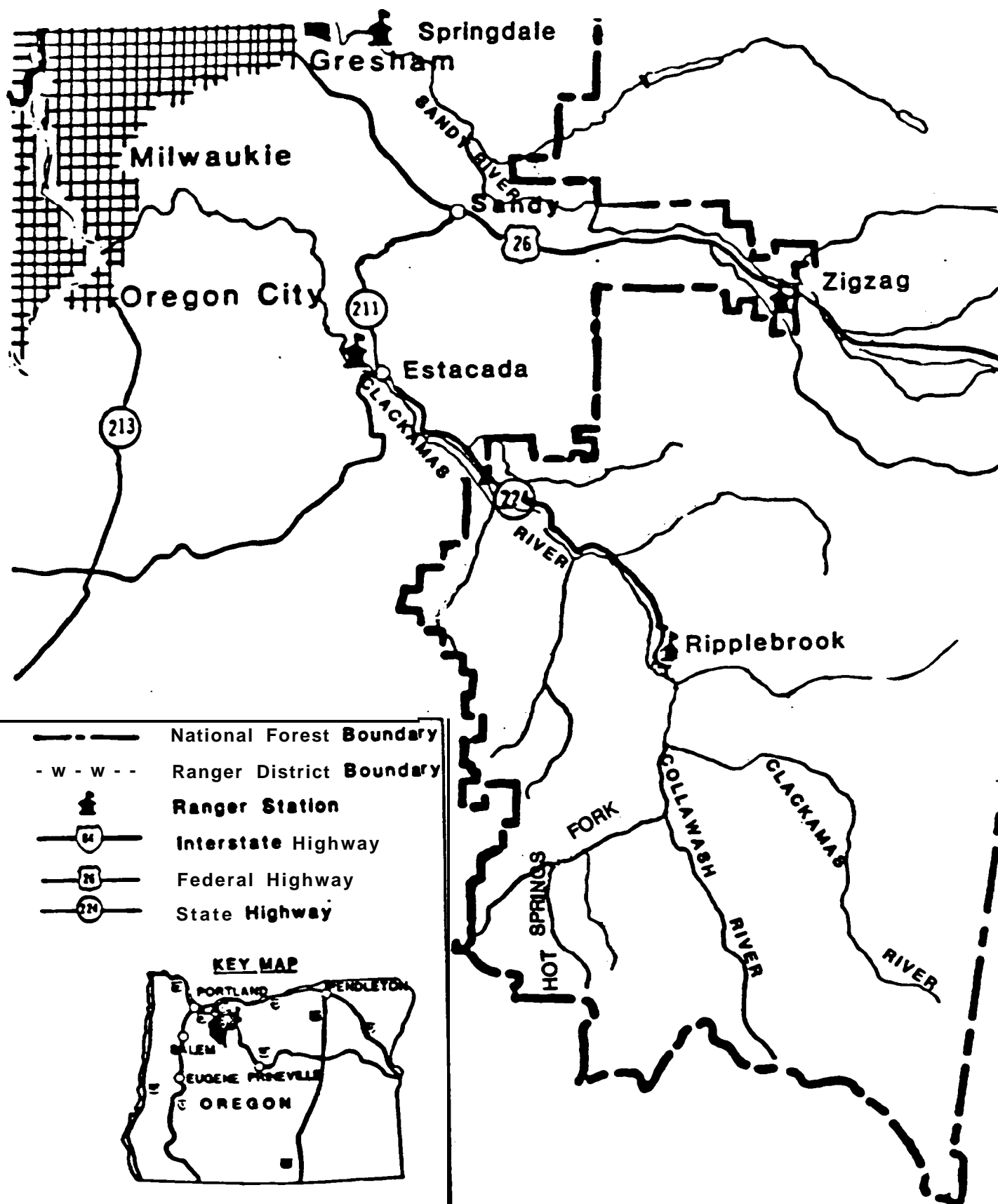


TABLE 9. Factors affecting rearing habitat quality and current anadromous fish production in the Hot Springs Fork.

<u>Stream Reach(RM)</u>	<u>Meters/Reach</u>	<u>Gradient</u>	<u>P:R</u>	<u>Existing Problems</u>
1 (0.0 - 0.5)	812	5%	4:6	lacks LWD/habitat complex
2 (0.5 - 2.1)	2,600	4%	5:5	low effective cover
3 (2.1 - 3.4)	2,112	3%	3:7	lacks pools, cover
4 (3.4 - 4.4)	1,600	2%	5:5	lacks cover, gravels
5 (4.4 - 5.1)	1,120	2%	4:6	scoured, lacks cover
6 (5.1 - 6.1)	1,600	1.5%	5:5	lacks cover, gravels
7 (6.1 - 9.1)	4,800	2.5%	3:7	lacks pools. cover
8 (9.1 - 10.2)	1,760	3.5%	3:7	lacks pools, cover

Rearing habitat is found in good quantity in the lower six miles of the stream, but lacks the effective cover required to ensure fry to smolt survival. There is very little rearing habitat in the upper four miles of Hot Springs Fork. Chinook production appears to be limited by poor spawning habitat distribution and inadequate adult holding habitat. Although there are about **26,000** square feet of gravel in the drainage much of it is located in the lower 2.5 miles of stream. The reach between RM 2.5 and RM 5.0 has virtually no accumulations of spawning gravel and very little adult holding habitat.

The Hot Springs Fork Habitat Improvement Project represents an ongoing project begun in 1985 to increase natural production of anadromous fish. Fish habitat improvement work on the Hot Springs Fork through 1986 focused on resolving passage barriers. Access to Pansy and Nohorn Creeks, major tributaries to the Hot Springs Fork, was improved in 1985 in a cooperative effort between BPA and the Forest. In 1986 the waterfall at RM 7.1 of the Hot Springs Fork was modified to improve passage conditions. Channel rehabilitation efforts to improve spawning and rearing conditions were also conducted in the lower reach of Pansy Creek (1985) and on the Hot Springs Fork mainstem from RM 2.9 to 3.8 (1986). Cost to date for the project is \$64,542.

### Management Objectives

The goal for anadromous fisheries management in the Hot Springs Fork drainage is to provide for and maintain optimal habitat conditions for the wild/natural production of spring chinook and coho salmon, and winter steelhead trout. To achieve this goal the management objectives are:

1. General Habitat Improvement Strategy. Aggressively develop and refine habitat enhancement techniques for steelhead trout, coho salmon, and where possible, chinook salmon. The focus of enhancement efforts is on increasing fish habitat complexity over the long term.
2. Species Specific Habitat Strategy.

Steelhead. Develop and implement a wide range of techniques aimed at providing preferred habitat with complex cover over the full range of seasonal conditions in the Hot Springs Fork of the Collawash River.

1. Glide/deep water riffle and pool habitat for 1+ steelhead. especially for low flow, late summer periods.
2. Alcove/edge habitat for 0+ steelhead. especially for transition and winter periods.

Coho. Develop and implement techniques to increase the amount and quality of slow water, sidechannel, offchannel. and edge habitats and maximize tributary spawning opportunities.

Spring Chinook. Improve spawning habitat distribution and maintain or improve holding habitat in the middle reach of Hot Springs Fork.



## II. PROJECT IMPLEMENTATION

The actions proposed for implementation are consistent with the Northwest Power Planning Council's Fish and Wildlife Program and the proposed Mt. Hood National Forest Land Management Plan. Development of this implementation plan and statement of work has been coordinated with and reviewed by the ODFW District Biologist with responsibility for the Clackamas River drainage. In addition, the Forest is involved in a cooperative effort with ODFW and PGE in a native coho evaluation effort in the upper Clackamas River that includes outplanting of smolts in the Hot Springs Fork.

### Implementation Criteria

The following criteria were considered in selecting specific habitat improvement activities to address limiting factors for anadromous fish production within the basin:

1. Cost/benefit. Based on several years of implementation experience on the Forest, habitat improvement activities selected for the Hot Springs Fork include those that provide the most immediate and long lasting benefit to fish production capability in the most cost effective manner available.
2. Location within the basin. Activities will generally be initiated in the lower stream reaches and proceed upstream to allow full utilization of woody debris introduced during improvement activities.
3. Logistic constraints. The availability of on-site materials and/or the access to bring in materials is an important consideration in selecting techniques and locations for habitat improvement work.
4. Treatment intensity. As a minimum, treatment in the Hot Springs Fork should average one large tree per 50 lineal feet of stream channel. The intensity of treatment in the 1986 project area was slightly greater than this average. Based on subsequent review it is felt that this treatment provided the physical changes expected, but that the increased treatment intensity would have resulted in additional habitat benefits. Emphasis will be on multi-log structures. These structures appear to provide the greatest habitat changes and stability in the stream channel.

Based on the preceding criteria full treatment of fish habitat in the Hot Springs Fork drainage is scheduled to be implemented over the next four work agreement periods (FY1988/89, 1989/90, 1990/91, and 1991/92). Low flow summer habitat inventories and the winter surveys of 1985 and 1986 were used to identify eight general areas with equipment access that have high potential for habitat improvement. FIGURE 8 portrays the location of the eight treatment reaches.

### Project Implementation

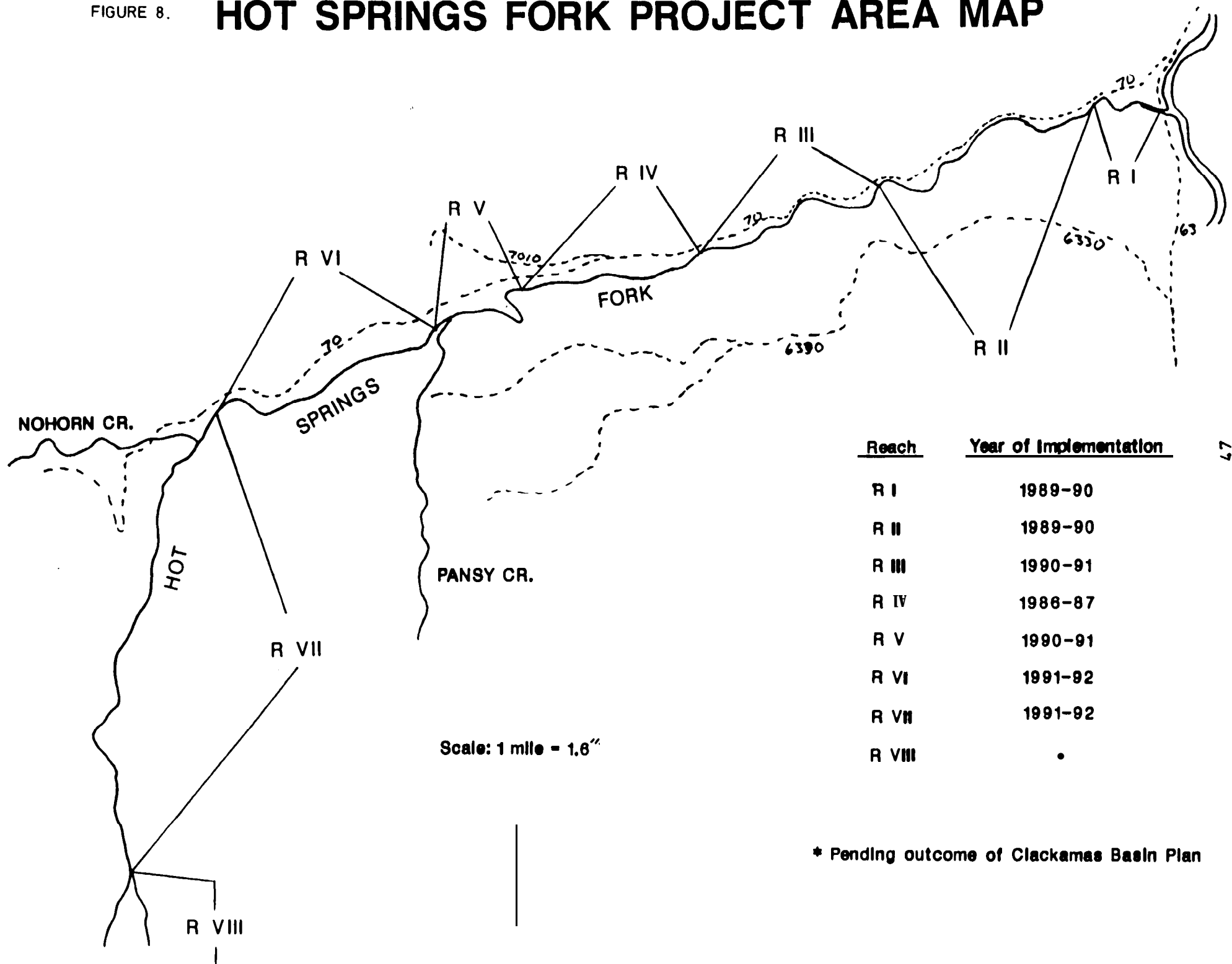
#### Summary of 1988/1989 Tasks

1. Design and plan habitat improvement measures for reaches 1 and 2 of the Hot Springs Fork Collawash River.

Schedule: Begin April 1, complete November 1, 1988.

FIGURE 8.

# HOT SPRINGS FORK PROJECT AREA MAP



- 2 Determine boulder stockpile areas for future project implementation and develop boulder haul contract.  
  
Schedule: Complete contract preparation by January 1. award by April 1, 1988.  
  
2.2 Implement boulder haul contract, delivering approximately 1000 boulders for use in project reaches 1-3 and 5-7.  
  
Schedule: Begin April 1, complete November 1. 1988.
- 3 Perform necessary maintenance of habitat improvement structures completed in 1986.  
  
Schedule: Begin July 1, complete November 1, 1988.
- 4 Complete basin mapping/inventory effort to provide initial assessment of the 1986 work effort and more precise baseline data to measure future project effectiveness.  
  
Schedule: Begin July 1, complete September 1, 1988.
- 5 Prepare annual report and work statement/budget modifications.  
  
Schedule: Begin November 1. 1988, complete March 31. 1989.

#### Summary of 1989/1990 Tasks

1. Finalize designs and planning for habitat improvement measures for reaches 3 and 5 of the Hot Springs Fork Collawash River.  
  
Schedule: Begin April 1, complete November 1, 1989.
2. Implement treatment of reaches 1 and 2 of the Hot Springs Fork Collawash River, providing for placement of approximately 240 log/rock complexes within the stream channel.  
  
2.1 Prepare equipment rental contracts for advertisement and award.  
  
Schedule: Complete contract preparation by January 1, award contract by April 1, 1989.  
  
2.2 Implement improvement project.  
  
Schedule: Begin June 1, complete November 1. 1989.
3. Perform necessary additional maintenance of improvements constructed in 1986.  
  
Schedule: Begin July 1, complete November 1. 1989.

4. Complete pre and post-implementation habitat/fish use inventories to provide baseline data on structure performance, durability, and resulting benefits.

Schedule: Begin July 1, complete September 1, 1989.

5. Prepare annual report and work statement/budget modifications.

Schedule: Begin November 1. 1989, complete March 31, 1990.

#### Summary of 1990/1991 Tasks

1. Finalize designs and planning for habitat improvement measures in reaches 6 and 7 of the Hot Springs Fork Collawash River.

Schedule: Begin April 1, complete November 1. 1990.

2. Implement treatment of reaches 3 and 5 of the Hot Springs Fork Collawash River, providing for placement of approximately 240 log/rock complexes within the stream channel and construction of about 300 feet of off-channel habitat.

2.1 Prepare equipment rental contracts for advertisement and award.

Schedule: Complete contract preparation by January 1. award by April 1. 1990 +

2.2 Implement improvement plans.

Schedule: Begin June 1, complete November 1. 1990.

3. Perform necessary maintenance of habitat improvement structures completed in 1989.

Schedule: Begin July 1. complete November 1, 1990.

4. Complete pre and post-implementation habitat/fish use inventories to provide baseline data on structure performance, durability, and resulting benefits.

Schedule: Begin July 1, complete September 1. 1990.

5. Prepare annual report and work statement modifications.

Schedule: Begin November 1, 1990, complete March 31. 1991.

#### Summary of 1991/1992 Tasks

1. Finalize designs and planning for fish habitat improvement measures in reach 8. contingent on the outcome of the Clackamas River sub-basin planning process.

Schedule: Begin April 1. complete November 1, 1991.

2. Implement treatment of reaches 6 and 7 of the Hot Springs Fork Collawash River, providing for placement of approximately 335 log/rock complexes within the stream channel.

2.1 Prepare equipment rental contracts for advertisement and award.

Schedule: Complete contract preparation by January 1, award by April 1, 1991.

2.2 Implement improvement plans.

Schedule: Begin June 1. complete November 1, 1991.

3. Perform necessary maintenance of habitat improvement structures completed in 1990.

Schedule: Begin August 1, complete November 1, 1991.

4. Complete pre and post-implementation habitat/fish use inventories to provide baseline data on structure performance, durability, and resulting benefits.

Schedule: Begin July 1, complete September 1, 1991.

4. Prepare final report (or annual report, pending outcome of Clackamas River sub-basin planning process).

Schedule: Begin November 1, 1991, complete March 31, 1992.

TABLE 10 presents the proposed implementation schedule by major task and fiscal year. TABLE 11 summarizes improvement activities, costs, and production increases by fiscal year.

### III. FISH PRODUCTION INCREASES

Using the smolt habitat capability index developed on the the Mt. Hood National Forest it is estimated that current annual smolt production in the Hot Springs Fork is 20,176 coho. 22,672 spring chinook, and 5,044 steelhead. With implementation of the planned fish habitat enhancement activities, it is estimated that production will be increased by an additional 7,249 coho, 2,616 chinook, and 4,229 steelhead smolts annually (TABLE 12). Production increases are based on the assumption that habitat improvement measures will increase habitat complexity, reduce predation, and reduce pre-smolt mortality during high flow events.

### IV. MONITORING

Pre and post-project monitoring of the physical and biological condition of the stream reaches will be conducted by a Forest monitoring/evaluation crew using the methodology developed by Hankin and Reeves (draft manuscript).

TABLE 10. Implementation schedule by task by fiscal year for the Hot Springs Fork drainage.

Stream Reach	Work Agreement Period			
	88-89	89-90	90-91	91-92
1	-----	+++++	/////	
2	-----	+++++	/////	
3		-----	+++++	/////
4	/	/		
5		----	+++++	/////
6			-----	+++++
7			-----	+++++
8				-----

TASK	TYPICAL IMPLEMENTATION PERIOD	
Design/plan	-----	April 1 - November 1 of year prior to construction year (CY)
Implementation	+++++	January 1 - April 1 of CY Contract prep/award June 1 - November of CY Project implementation
Maintenance	/////	July 1 - November 1 of year after CY
Monitoring	_____	July 1 - September 1 of CY. plus 2-4 years after CY

TABLE 11. Improvement activities, costs, and production increases by reach for the Hot Springs Fork drainage.

Stream Reach	Agrmnt. Year	Structures (Est. #)	Offchannel (Est. ft.)	cost Est.	Production Increase/Yr
1	89-90	57		\$23,631	710 smolts
2	89-90	182		\$86,331	2600 smolts
3	90-91	148	300 ft.	\$79.950	2110 smolts
4	86-87	135	400 ft.	\$16.612	2400 smolts
5	90-91	95		\$63.565	1680 smolts
6	91-92	135		\$37.569	1400 smolts
7	91-92	200		\$83,844	3195 smolts

TABLE 12. Estimated increase in smolt production resulting from fish habitat enhancement on the Hot Springs Fork.

Species	Stream Area (m <sup>2</sup> )	Current		Potential		Increase
		Density	Number	Density	Number	
Coho	120,820	0.16	19,331	0.22	26,580	+7,249
Chinook	87,200	0.26	22,672	0.29	25,288	+2,616
Steelhead	120,820	0.04	4,833	0.075	9,062	+4,229



## V. COST

Projected project costs are summarized by fiscal year and major task in TABLE 13. Detailed annual project budgets are included in Attachment I, Budget.

TABLE 13. Summary of proposed expenditures by fiscal year and implementation task for the Hot Springs Fork Collawash River habitat improvement project.

Major Task	Work Agreement Period			
	1988-89	1989-90	1990-91	1991-92
<u>Direct Costs</u>				
1. Design/Imp.	58,888	68,200	97,158	91,948
2. Evaluate	3,500	3,500	3,500	3,500
3. Maintenance	9,600	9,600	9,600	9,600
<u>Indirect Costs</u>				
1. Overhead	3,179	5,886	7,099	6,744
<b>TOTAL COSTS</b>	75,167	87,186	117,357	111,792

1988-1991 IMPLEMENTATION PLAN & WORK STATEMENT

LOWER OAK GROVE FORK, CLACKAMAS RIVER HABITAT IMPROVEMENT

ADMINISTRATIVE SUMMARY:

Project Leader: Dave Heller Phone: (503) 666-0762

Project Number: 84:11. Subproject V

Project Period: April 1. 1988 - March 31. 1991

Project Headquarters: USDA Forest Service  
Mt. Hood National Forest  
2955 N.W. Division Street  
Gresham, OR 97030

Administrative Contact: Harv Forsgren Phone: (503) 666-0605

I. INTRODUCTION

The Oak Grove Fork of the Clackamas River (T.6S.. R.6E., Sec. 3) is a fifth order tributary of the Upper Clackamas River (FIGURE 9). The basin area is 140 square miles and mainstem length is 21 miles, all on National Forest System lands. Anadromous fish migration is limited to the lower 3.8 miles of the Oak Grove Fork. Access above this point is blocked by a waterfall. The stream supports runs of coho and chinook salmon, and summer and winter steelhead.

The Harriet Lake Dam at RM 4.8 diverts virtually the entire low flow of the Oak Grove to the Portland General Electric power generation facilities at Three Lynx. There is no provision for regulated minimum flows from Harriet Lake to the Lower Oak Grove, nor is there any facility or mechanism to provide any outflow. However, seepage at the base of the dam provides approximately 7 to 10 cfs of flow year-round, and several second order tributaries located in the first mile below the dam (Sam, Skunk. and Canyon Creeks) provide an additional 5 to 7 cfs of flow during low flow periods. During high flow periods run-off spills over the dam.

Smolt production is presently estimated to be below average for a Clackamas River tributary. Although spawning habitat is of marginal quality and low in quantity, averaging only 130 square yards per stream mile, it is apparent that anadromous production in the Oak Grove Fork is limited by rearing habitat quantity and quality. Fisheries habitat inventories of the Lower Oak Grove Fork show the stream to have limited pool. deep glide, and off-channel habitats. The pool habitat available is generally characterized as shallow with little effective cover.

Fiscal year 1988/89 is the fourth year of a multi-year BPA funded program to enhance anadromous fish rearing and spawning habitat in the lower 3.8 miles of the Oak Grove Fork. In 1986 habitat enhancement activities were initiated in

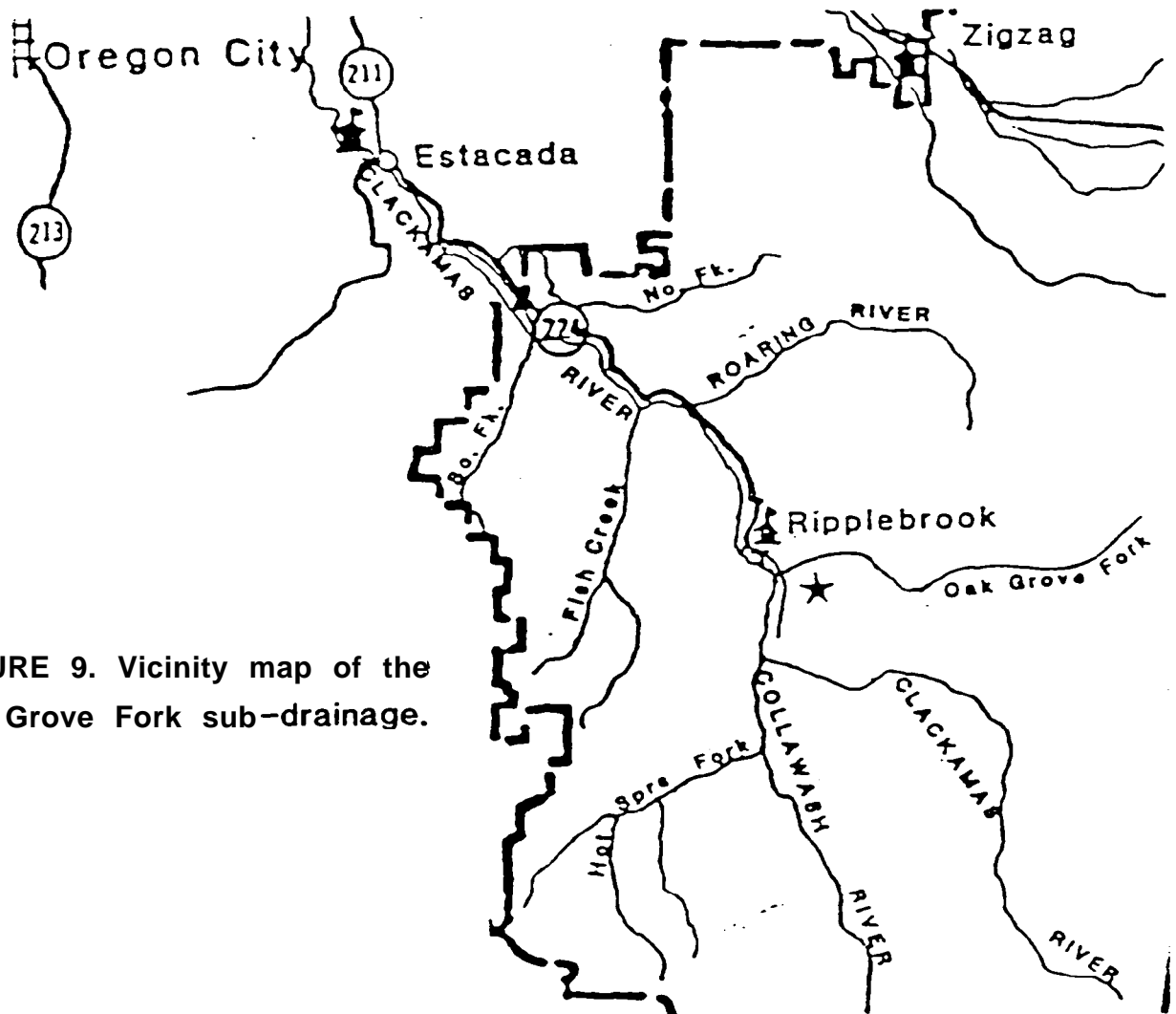
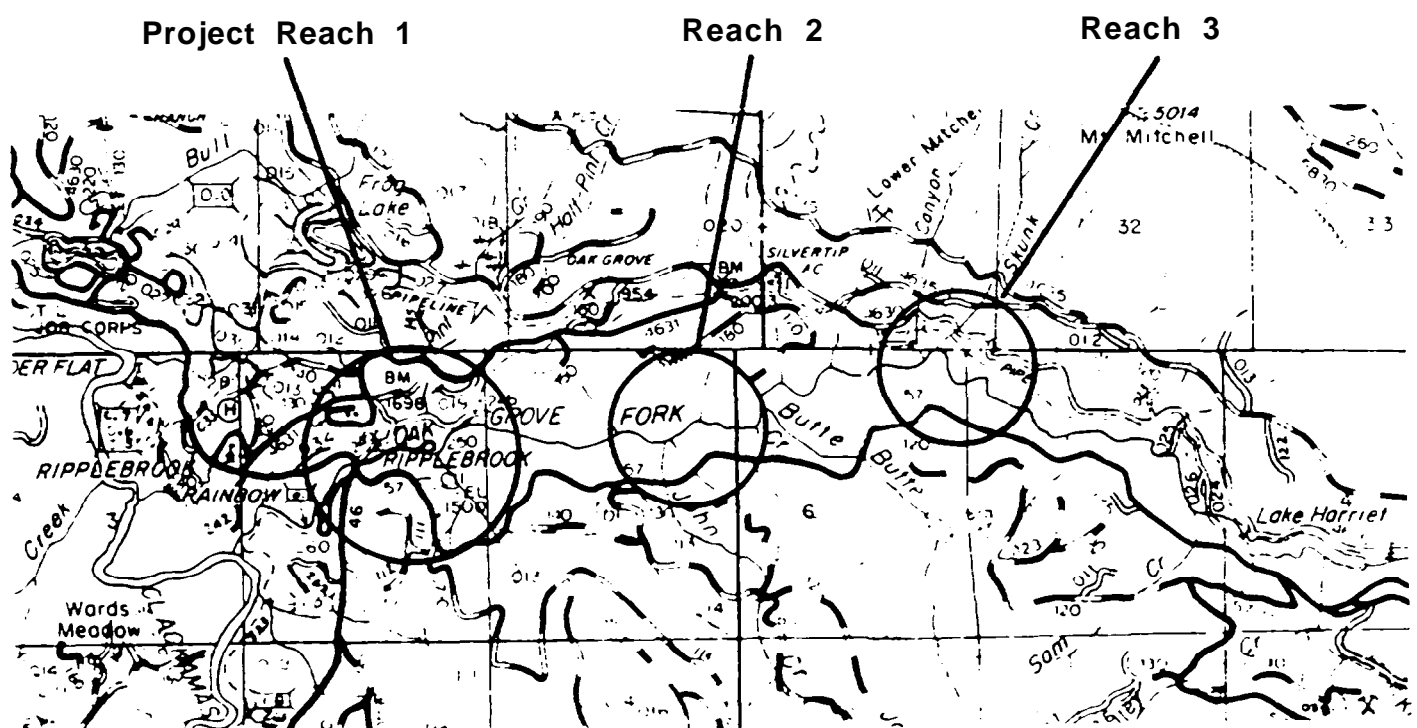


FIGURE 9. Vicinity map of the Oak Grove Fork sub-drainage.



project Reach 1 (RM 0.25 to 0.75) and resulted in the development of a 1050 foot long side channel (1825 square yards of rearing habitat) and boulder berm/cluster structure placement in 1650 feet of the mainstem. Additional enhancement sites were identified in 1987 in the middle and upper reaches of the Lower Oak Grove Fork. Specific project plans were developed for these sites in coordination with the Oregon Department of Fish and Wildlife and Portland General Electric fisheries biologists. Clackamas Ranger District personnel prepared the associated environmental assessment documents. Post-project monitoring of the 1986 project reach sites was also completed during the 1987/8 work agreement period.

Improvement activities proposed for implementation during the 1989/90 work agreement period are located in Reach 2 at RM 1.5 to 2.0 (FIGURE 9). The proposed activities include development of 1365 feet of side channel to provide optimum quiet water rearing habitat (approximately 40 sills/ponds) and 2300 feet of mainstem structure placement (approximately 115 boulder/log half-berm and cluster structures) to cause scouring, recruit spawning gravels and create rearing pools. Other activities planned for 1990/91 include continued monitoring of the 1986 enhancement sites, limited maintenance of improvement structures, preparation of required BPA reports, and development of site plans for 1990/91 project reaches.

Improvement activities proposed for implementation during the 1990/91 work agreement period will include development of additional rearing and spawning habitat in Reach 3 at RM 2.5 to 3.5 of the Lower Oak Grove Fork (FIGURE 9). Monitoring of prior project reaches will also be continued.

### Management Objectives

The goal for anadromous fisheries management in the Lower Oak Grove Fork is to provide for and maintain optimal habitat conditions for the natural production of coho salmon and steelhead trout. To achieve this goal the management objectives are:

#### 1. General Habitat Improvement Strategy

Apply state-of-the-art anadromous fish instream habitat enhancement techniques in selected stream reaches to improve and increase rearing habitat, and secondarily increase spawning habitat.

#### 2. Species Specific Habitat Improvement Strategy

Coho Salmon - Implement techniques to increase the amount and quality of slow water with instream and overhead fish cover, sidechannels, offchannels, and edge habitats. Develop mainstem structural habitat complexity to recruit and retain suitable spawning gravels.

Steelhead - Implement techniques to provide glide/deep water riffle and pool habitat for 1+ age steelhead during low flow periods, and alcove/edge habitat for 0+ steelhead during transition and high flows. Develop mainstem structural habitat complexity to recruit and retain suitable spawning gravels.

## II. PROJECT IMPLEMENTATION

### Implementation Criteria

The following criteria were applied to prioritize and select specific habitat improvement activities within the Lower Oak Grove Fork.

1. Logistic constraints: Access for materials and equipment to the Lower Oak Grove is limited and dependent upon the existing road system. Both the 1989/90 and 1990/91 improvement activity stream reaches are located directly off the end of two unimproved but passable logging "spur" roads.
2. Improvement potential: Reach selection was keyed to the presence of workable side channels, width of the flood plain. and availability of suitable on-site materials (boulders, downed wood), to maximize improvement potential and cost efficiency.
3. Cost/benefit: Activities planned for the identified reaches of the Lower Oak Grove include those providing immediate and lasting benefits to fish production capability in the most cost effective manner available.

### Summary of 1989/1990 Tasks

1. Develop **1365** feet of side channels and improve 2300 feet of Reach 2 of the mainstem of the Lower Oak Grove Fork to increase available anadromous fish rearing habitat.
  - 1.1 Complete necessary environmental documentation and coordinate project work to meet Spotted Owl management concerns.  
  
Schedule: Begin November 1, 1987, complete April 1, 1989.
  - 1.2 Complete necessary contract(s) and locate on maps the preferred equipment access route, work areas, etc.  
  
Schedule: Begin October 1, 1987, complete May 1, 1989.
  - 1.3 Mark all (downed) trees suitable for structure use. Mark for in-stream recruitment all suitably large boulders above the mean high water mark.  
  
Schedule: Begin June 1, complete July 1, 1989.
  - 1.4 Implement improvement work with heavy equipment rental and District hand crews to create about 1365 feet of side channel and adding approximately 115 structures to 2300 feet of mainstem channel.  
  
Schedule: Begin July 15, complete September 1, 1989.
2. Continue monitoring of past project work in Reach 1, and collect base data on habitat characteristics in Reaches 1 and 2.

2.1 Collect pre and post-treatment fish population, structure performance, and habitat data.

Schedule: Begin July 1, complete August 1, 1989.

2.2 Conduct field reviews with ODFW and peer biologists to determine if project objectives have been met.

Schedule: Begin August 1, complete November 1. 1989.

3. Conduct any necessary maintenance of 1986 structures.

Schedule: Begin September 1, complete September 15. 1989.

4. Prepare annual report and work statement/budget modifications.

Schedule: Begin November 1, 1989. complete March **31**, 1990.

5. Draft detailed project plans for the 1990/91 treatment sites.

Schedule: Begin June 1, complete November 1, 1989.

6. Develop 1990/91 Improvement Project equipment rental contracts.

Schedule: Begin January 1990. complete March 1, 1990.

7. Prepare 1990/91 Improvement Project Environmental Assessment documents.

Schedule: Begin January 1990. complete March **31**. 1990.

#### Summary of 1990/1991 Tasks

1. Refine project work plans for improvement of Reach **3** (RM 2.5 - 3.5).

Schedule: Begin April 1, complete July 1. 1990.

2. Advertise and award equipment rental contracts.

Schedule: Begin April 1, complete **May 15**. 1990.

3. Complete field layout and marking of available material for project recruitment (boulder, log), flagging of equipment access, etc.

Schedule: Begin May 1, complete July 1, 1990.

4. Implement improvement activities as planned with contracted equipment and operator, and District hand crews.

Schedule: Begin July **15**. complete September 1, 1990.

5. Continue monitoring of past project reaches, and collect base data on habitat characteristics in reaches proposed for treatment.

5.1 Collect pre and post-treatment fish population, structure performance, and habitat data.

Schedule: Begin July 1, complete August 1, 1990.

5.2 Conduct field reviews with ODFW and peer biologists to determine if project objectives have been met.

Schedule: Begin August 1, complete November 1, 1990.

6. Conduct necessary maintenance of 1986 and 1989 structures.

Schedule: Begin September 1, complete October 1, 1990.

7. Prepare annual report and work statement/budget modifications.

Schedule: Begin November 1, 1990. complete March 31, 1991.

8. Identify and implement out-year project emphasis areas, including coordinated efforts to initiate minimum flows from Harriet Lake, with an objective to increase numbers of naturally reproducing anadromous fish in Lower Oak Grove Fork.

Schedule: Begin June 1, 1990, complete March 31, 1991.

#### Summary of 1991/1992 Tasks

1. Continue monitoring of post project reaches, and collect base data on habitat characteristics in additional reaches proposed for treatment (pending out-come of the Clackamas River sub-basin planning process).

Schedule: Begin July 1. complete August 1, 1991.

2. Conduct necessary maintenance on 1986, 1989, and 1990 improvement structures, and complete any adjustments/refinements of completed structures to complete treatment of the Lower Oak Grove Fork.

Schedule: Begin August 1. complete October 1, 1991.

3. Prepare final report and work statement/budget modifications.

Schedule: Begin November 1, 1991. complete March 31, 1992.

### III. FISH PRODUCTION INCREASES

Estimates of annual fish production increases resulting from development of side channels and adding structure to the mainstem of the Oak Grove Fork in 1989/90 and 1990/91 are about 3200 smolt. or more than 200 ocean adult salmon and steelhead per year. These estimates are based on: 1) area of suitable rearing habitat created by the enhancement activities: 2) assumed smolt production capabilities, and ; 3) assumed smolt to adult survival ratios. These habitat, production, and survival coefficients are summarized below.



1. Suitable rearing habitat created averages 20 feet wide for side channel and mainstem ponds/pools:

Side channels created - 2730 feet

2730 ft. X 20 ft. X 0.09 sq. m./sq. ft. = 4914 square meters

Mainstem treated - 4600 feet (of which approximately 50% will be suitable rearing habitat)

4600 ft. X 20 ft. X .50% X 0.09 sq. m./sq. ft. = 4140 square meters

Total rearing habitat created

4914 sq. m. + 4140 sq. m. = 9054 square meters.

2. Potential smolt production by species (based on SMOLT/HABITAT capability developed by the Mt. Hood National Forest)

9054 sq. m. X 0.075 smolt/sq m. = 680 steelhead smolt

9054 sq. m. X 0.280 Smolt/sq m. = 2536 coho smolt

TOTAL = 3216 SMOLTS/YEAR

3. Potential adult production by species.

680 steelhead smolt X 0.1 smolt to ocean adult survival = 68 adults

2536 coho smolt X 0.055 smolt to ocean adult survival = 140 adults

TOTAL = 208 OCEAN ADULTS/YEAR

#### IV. MONITORING

Baseline photo assessment stations and maps were established for the 1986 project area (Reach 1) to track structure performance and physical habitat changes following seasonal high flow periods. Pre and post-project monitoring of the physical and biological condition of all stream reaches treated, will be conducted by a Forest monitoring and evaluation crew using the methods developed by Hankin and Reeves (draft manuscript).

#### V. COSTS

Projected costs are summarized by fiscal year in TABLE 14. Detailed annual project budgets are included in Attachment I, Budgets. Costs for the out-year project work may require adjustment when work statements are up-dated for those years.

TABLE 14. Summary of proposed expenditures by fiscal year for the Lower Oak Grove Fork, Clackamas River habitat improvement project.

	1989-90	1990-91	1991-92	Total
Direct Costs	837.820	839.560	37,440	\$84.820
Indirect Costs	2,738	2,827	893	6.458
Yearly Total	\$40.558	\$42.387	<b>\$8.333</b>	\$91.278

PROJECT SUMMARY  
FIFTEENMILE CREEK HABITAT IMPROVEMENT  
1988-1992 STATEMENT OF WORK

2.1 Administrative Summary:

Project Leader: Dave Heller

Phone: (503) 666-0762

Project No. 84:11, Subproject VI

Project Period: April 1, 1988-March 31, 1992

Project Headquarters: USDA Forest Service  
Mt. Hood National Forest  
2955 N.W. Division St.  
Gresham, Oregon, 97030

Administrative Contact: Harv Forsgren

Phone: (503) 666-0605

SUMMARY OF THE PROBLEM

Fifteenmile Creek is a fifth order tributary to the Columbia River, entering the Columbia just downstream of the Dalles Dam (FIGURE 10). Fifteenmile Creek and its major tributaries, Eightmile Creek, Ramsey Creek and Fivemile Creek, support the easternmost run of wild winter steelhead trout in the Oregon portion of the Columbia Basin. Fifteenmile Creek drains the northeast corner of the Mt. Hood National Forest. The upper third of Fifteenmile Creek and the above mentioned tributaries flow through National Forest land while lower reaches of the streams flow through private agricultural land.

Fish habitat quality on National Forest land is generally rated as fair to good. Factors limiting habitat quality within the Forest include a lack of habitat diversity, passage barriers, low summer flows and sediment. The lack of diverse low flow rearing habitat for 1+ steelhead is felt to be the most serious factors limiting anadromous fish production capability.

The Fifteenmile Basin Habitat Improvement Project, initiated in 1985, is a multi-year joint effort between the Oregon Department of Fish and Wildlife, and Mt. Hood National Forest coordinated with the Confederated Tribes of Warm Springs to improve anadromous fish production in the Fifteenmile Basin. In 1987 BPA approved a detailed implementation plan prepared by the cooperating agencies and tribe. As outlined in the plan, the Forest Service is the lead agency for projects on National Forest land (FIGURE 11) while ODFW is taking the lead for implementation on private lands. Interested readers are referred to the implementation plan for additional details on project background, benefits, etc. (Smith, et. al. 1987).

Ramsey Creek

Ramsey Creek is a third order tributary to Fifteenmile Creek. The mouth is approximately 7.5 miles below the National Forest Boundary. The portion of

FIGURE 10.

STATE ENGINEER OF OREGON  
WATERSHED PLANNING DIVISION

PROJECT MAP  
FIFTEENMILE CREEK WATERSHED

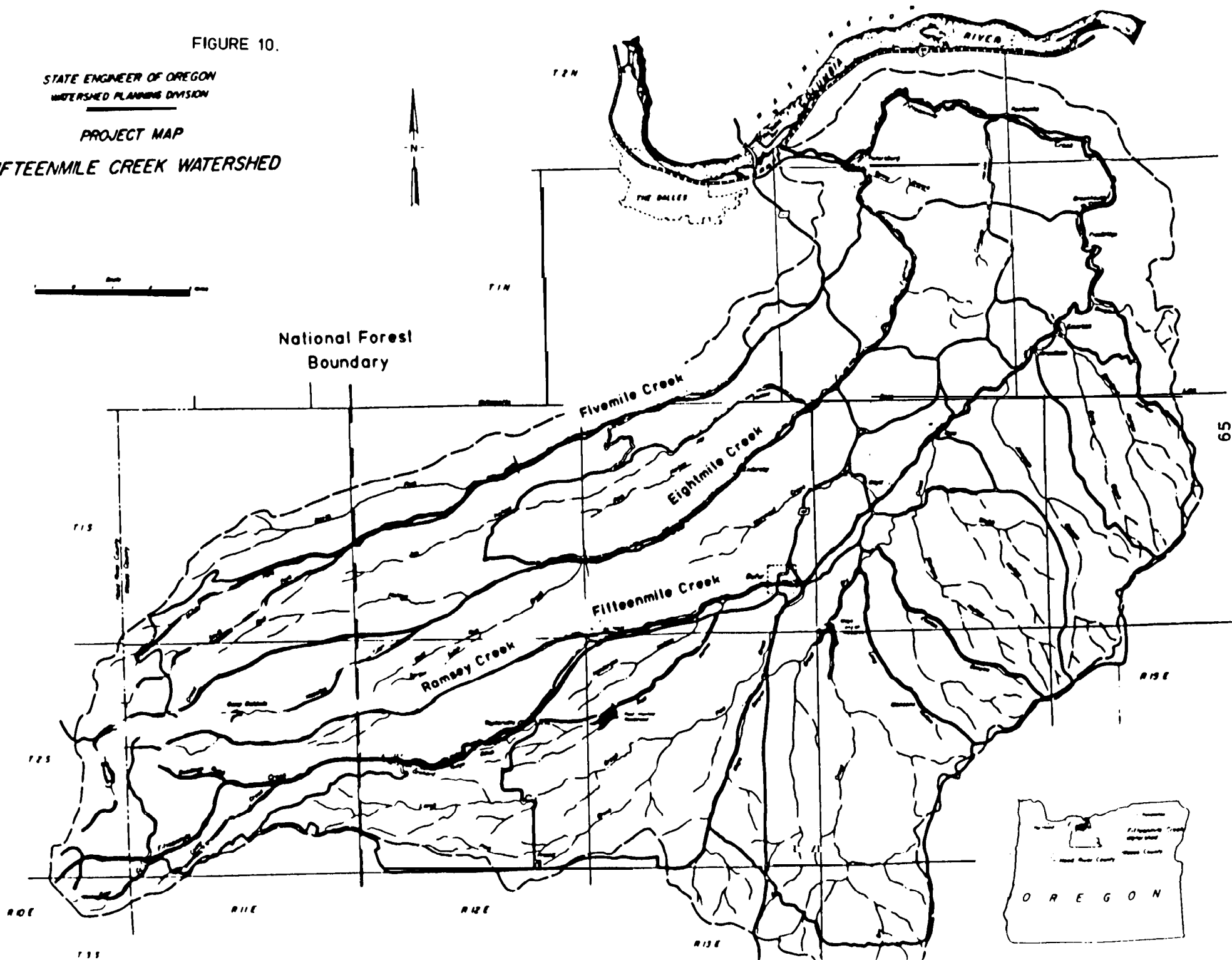


FIGURE 11.

# FIFTEENMILE BASIN ON NATIONAL FOREST LAND

Scale = 3/4" = 1 mile

Road



Campground



Thermograph

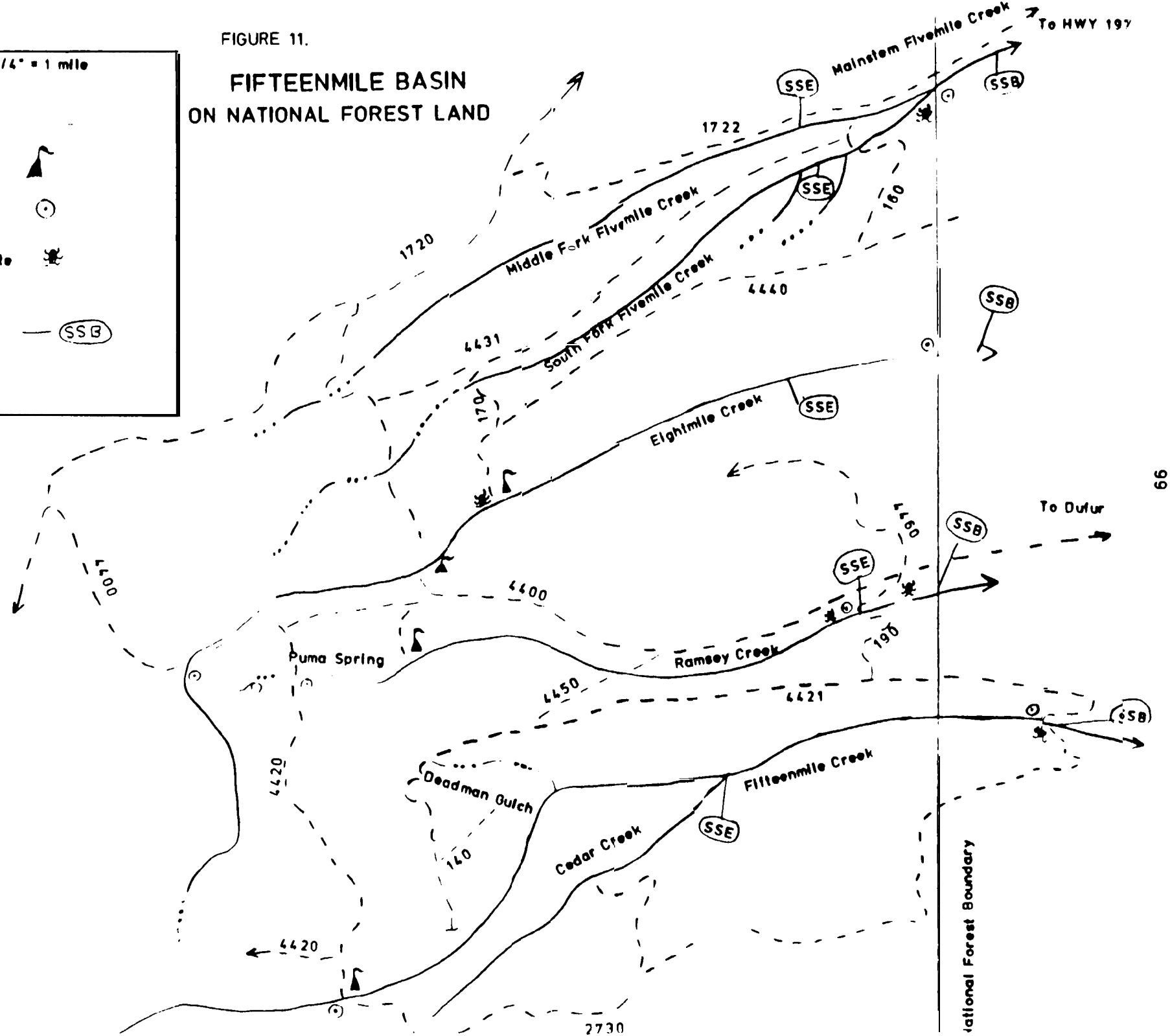


Insect Sample Site

Drainage Survey



Begin End



Ramsey Creek flowing through National Forest land is identified as Ramsey Creek Reach 2 in the Fifteenmile Basin Implementation Plan. Fish habitat quality in Reach 2 is rated as fair. Impeded passage for adults and limited low flow rearing habitat for 1+ steelhead are the primary factors limiting increased production. Passage impediments are related to road crossings and will, or have been corrected with Forest Service funds. Low flow rearing habitat deficiencies are reflected by the low percentages of high quality pool and glide habitat. The major factors contributing to this situation are lack of instream structure and local sediment deposition.

Past habitat improvement work in Ramsey Creek has included passage improvement at two culverts and road rehabilitation (funded by the Forest Service), and placement of in-stream structures between R.M. 7.5 and approximately R.M. 8.3. This project will complete habitat improvement work between R.M. 8.5 and 11.5. Primary focus of planned project work will be the installation of wood structures to improve habitat diversity by creating pools, providing cover and collecting spawning gravel.

#### Eightmile Creek

Eightmile Creek is a fourth order tributary to Fifteenmile Creek, entering the mainstem well below the National Forest boundary, at about R.M. 2.7. The portion of Eightmile Creek on National Forest land has been identified as Reach 3 in the Fifteenmile Basin Implementation Plan. Fish habitat quality in Reach 3 is rated as fair to good. Factors negatively influencing steelhead production capability in the reach include potential adult passage barriers at numerous log jams, two culverts, an unscreened irrigation diversion, and a lack of low flow rearing habitat for 1+ steelhead. Most of the habitat improvement work planned for Eightmile Creek will be implemented with Forest Service funding.

#### Fifteenmile Creek

Anadromous fish habitat quality on the National Forest portion of Fifteenmile Creek (Reach 4 in the Implementation Plan) is rated as fair to good. Steelhead production appears limited primarily by the amount and quality of low flow rearing habitat for 1+ steelhead. Past removal of large wood structure has resulted in a decline of high quality pool and deep glide habitat preferred by 1+ steelhead.

#### Fivemile Creek

Fivemile Creek, the northernmost tributary of the Fifteenmile system, drains into Eightmile Creek approximately 1.5 miles above the confluence of Eightmile and Fifteenmile Creeks. The lower 18.2 miles of Fivemile Creek flow through private land.

Fish habitat quality on National Forest land is rated as poor to fair. The major limiting factors are low flow rearing habitat due to low summer discharge and poor pool quality (shallow depth and little cover). Suitable spawning gravel is also limited in the stream, but it is felt to be a secondary limiting factor. Habitat improvement work in Fivemile Creek is being coordinated between proposed BPA funded work and projects planned for Forest Service funding.

## PROPOSED SOLUTION

The Forest Service has surveyed, mapped and quantified stream habitat in the Fifteenmile Basin. Stream reaches below the National Forest boundary have been surveyed by ODFW. Habitat improvement plans have been developed on Ramsey Creek, Fifteenmile Creek, and Fivemile Creek. Corrective actions for these streams are listed in the Statement of Work. The Forest Service is engaged in a baseline monitoring program in coordination with ODFW. The monitoring includes spawning surveys, basin wide temperature monitoring and macroinvertebrate analysis. The Forest is also funding work (approximately \$20-30,000/year) to reduce sediment delivery from upland areas in the drainage.

## COORDINATION

**All** proposed actions are consistent with the Northwest Power Planning Council's Fish and Wildlife Program, Mt. Hood National Forest Planning and the approved Fifteenmile Creek Implementation Plan. Coordination will continue with ODFW, Confederated Tribes of Warm Springs and BPA.

## IMPLEMENTATION

A statement of work is presented below which describes the objectives of the Fifteenmile Basin Habitat Improvement Programs and the tasks necessary to accomplish those objectives. Project reaches discussed in this statement of work are displayed in FIGURE 12.

### FY 1988-91 Statement of Work

Objective 1: Baseline Basin-wide Monitoring in coordination with the Oregon Department of Fish & Wildlife.

Task 1: Conduct spawning surveys on National Forest land as relative indicator of population status and trends.

Schedule: Begin April 1, continue through May 15, 1988/1991.

Task 1.2: Continue macroinvertebrate monitoring as described in 1987 Statement of Work and 1986 Final report. Coordinate with ODFW, sending samples to Dr. Fred Mangum- USDA Forest Service, Region 4 for analysis.

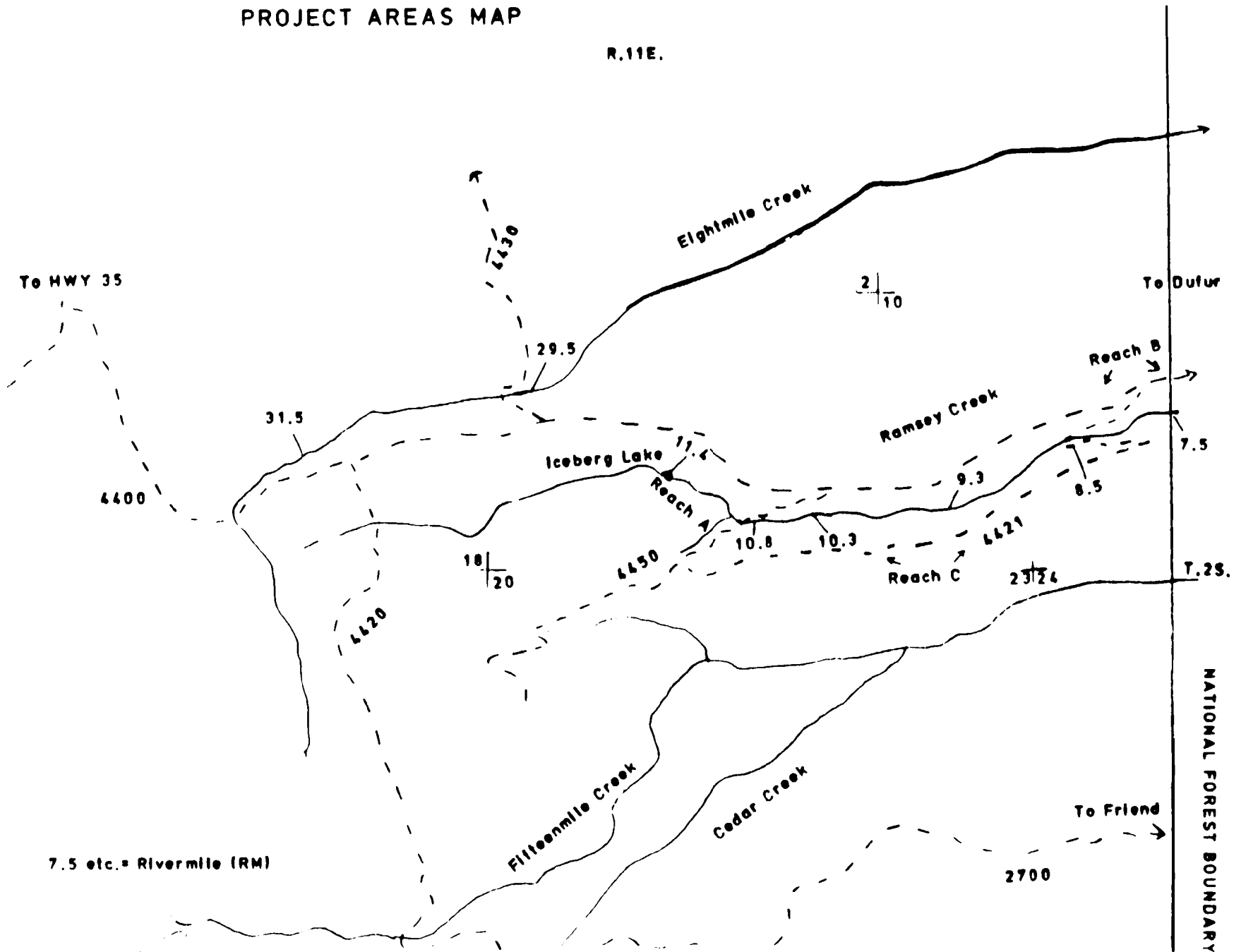
Schedule: One sample day in April, one in July, one in October, 1988-1991.

Task 1.3 Continue water temperature monitoring. Sites as described in 1986 Final Report.

Schedule: Approximately April 1, through October 31, 1988-1991.

FIGURE 12. FIFTEENMILE BASIN

PROJECT AREAS MAP





Objective 2: Ramsey Creek Habitat Improvement

Ramsey Creek Improvement Tasks 1988-1989

Task 2.1 Maintain structures installed and completed in 1986 and **1987**. Actual maintenance needs will have to be determined after winter flows. Little maintenance is anticipated.

Schedule: Review structures in April, 1988.  
Perform identified maintenance by August 31, 1988.

Task 2.2 Complete installation of in-stream structures between river mile (RM) 8.3 and 11.4. Plans include approximately 70 structures (log sills, wings, cover logs) to be constructed by a small track-mounted backhoe. Hand crews will build structures (primarily wings and cover logs) at approximately 25 sites where machine access is limited.

Schedule: Begin final design, layout and contract preparation in April, 1988; complete project by August 31, 1988.

Task 2.3 Continue pre and post-project monitoring to document changes in fish habitat as a result of project work.

Schedule: Begin field work about July 1, 1988.  
Final write-up completed by December 30, 1988.

Task 2.4 Conduct post treatment peer review of Ramsey Creek to insure all opportunities for habitat improvement have been identified and habitat objectives for the stream have been met. Review team will include other Mt. Hood National Forest biologists, ODFW biologists, and a biologist for the Confederated Tribes of Warm Springs.

Schedule: Review will be planned for August 1988. Pending results of the review, planning for future projects would start in October, 1988 and be completed by March 31, 1988.

Ramsey Creek Improvement Tasks 1989-1990

Task 2.5 Continue post project monitoring to document changes in fish habitat as a result of project work.

Schedule: Begin field work about July 1, 1989.  
Final write-ups completed by December 30, 1989.

Objective 3. Fifteenmile Creek Habitat Improvement

Fifteenmile Creek Improvement Tasks 1988-1989

Task 3.1 Complete project planning and environmental analysis report for habitat improvement work in the mainstem Fifteenmile from the Forest Boundary to the upper limit of potential

anadromous fish production. In implementation plans for 1989 and 1990 it is anticipated that final treatment will include falling and blasting trees into the channel to increase in-stream cover, habitat diversity and improve dispersal of spawning gravel. Treatment is planned for the portion of the treatment area accessible by track mounted heavy equipment. About 20-30 structures per mile will be installed. A lower intensity of treatment is planned where equipment access is limited. Hand crews will be used to install about 10-20 structures per mile.

Schedule: Begin in May, 1988, finish environmental analysis by March, 1989.

#### Fifteenmile Creek Improvement Tasks 1989-1991

Task 3.2 Implement habitat improvement project in the mainstem of Fifteenmile Creek. Treatment will most likely include falling and blasting of trees into the channel to increase habitat diversity by creating pools, providing cover and collecting spawning gravel. Approximately three miles of stream will be treated with approximately 80 structures. Treatment planned for the portion of the treatment area accessible by track mounted heavy equipment will be of moderate intensity (20-30 structures per mile). A lower intensity of treatment is planned where equipment access is limited. Hand crews will be used to install about 10-20 structures per mile. Reaches to be treated will be monitored before treatment and in 1990 and 1991 to document changes in fish habitat.

Schedule: Pre-project monitoring in July, 1989  
Implementation in July-August, 1989. 1990  
Post-project monitoring in July 1990. 1991

#### Objective 4. Fivemile Creek Habitat Improvement.

##### Fivemile Creek Improvement Tasks 1988-1989

Task 4.1 Complete project planning and environmental analysis report for habitat improvement work in the mainstem Fivemile Creek from the National Forest boundary upstream to the confluence of the Middle and South Forks of Fivemile.

Schedule: July-August 1989. Final EA complete by March 31, 1990.

##### Fivemile Creek Improvement Tasks 1989-1990

Task 4.2 Implement Fivemile Creek Habitat Improvement Project. It is anticipated that approximately 40 structures will be installed to increase habitat diversity by improving low flow pool habitat and providing cover. Structures will

likely include log sills and wings.

Schedule: Implementation during July or August 1990.

Task 4.3 Monitor changes in fish habitat due to project work.  
Habitat in treated reaches will be quantified before  
project work commences and in 1991.

Schedule: Prior to implementation in 1990 and in July or  
August 1991.

The proceeding tasks identified in the Statement of Work deviate slightly from the schedule outlined in the Implementation Plan. According to the Implementation Plan, habitat improvement work should begin in Eightmile Creek in 1988. Project work in Eightmile Creek will continue in 1988. but will be funded by the Forest Service. It is currently anticipated that most, if not all of the planned Eightmile Creek habitat improvement can be completed with Knudson-Vanderberg Act funds generated by adjacent timber sales .

It is also assumed that the Forest Service will continue to coordinate and process the macroinvertebrate and thermograph monitoring for the basin.

#### COSTS

TABLE 15 summarizes project costs by fiscal year. Detailed project budgets are presented in Attachment I, Budget. The proposed costs probably represent the high range of cost estimates. Machine contract costs shown are based on the highest cost paid in past contracts. Maintenance costs are included but past experience has indicated that maintenance needs should be minimal. Personnel costs include labor and contract administration. It is assumed that most of the work will be completed using equipment rental contracts and Forest Service personnel will provide the labor and supervise contractors.

TABLE 15. Summary of proposed expenditures by fiscal year for the Fifteenmile Basin Improvement Project.

<u>Fifteenmile Basin Project costs</u>	<u>1988-89</u>	<u>1989-90</u>	<u>1990-91</u>	<u>1991-92</u>	<u>Line Total</u>
Direct Costs	\$48,773	\$44,816	\$34,150	\$20,590	\$148,329
Indirect Costs	\$3,360	\$3,531	\$2,548	\$1,555	\$10,994
Grand Total	\$52,133	\$48,347	\$36,698	\$22,145	\$159,323

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